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I

ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE.

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ANNALS OF SURGERY.

THE TECHNIQUE OF LARYNGECTOMY.¹

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ALL surgical operations are subject to the law of evolution. This is especially true of the rate of mortality, which, in the early days of every new operation, is apt to be very great, but progressively diminishes as we learn the errors that have attended the technique.

I have been ill satisfied with the usual technique of laryngectomy, and, as in a recent case I adopted a method which rendered the operation one of simplicity, caused but little loss of blood and little shock, and avoided the danger of aspiration pneumonia, I venture to bring it before the association in the hope that it will be tested by others so as to determine its real value. Instead of being a very severe and dangerous operation, as it has hitherto been regarded, I hope this will place it in the category of safe operations. Certainly it would seem that an operation in which the patient was out of bed on the fourth day, and was practically well on the tenth day, entire union by first intention having been secured, may be so classified.

Nearly all authors, whether surgeons or laryngologists, speak of the operation as an extremely severe and dangerous one, and this view is warranted by its past high mortality.

Thus Rutsch (*Deutsche Zeitschrift für Chirurgie*, 1899, l. 484) speaks of the "recovery as very doubtful." Send-

¹ The President's Address at the meeting of the American Surgical Association, May 31, 1899.

ziak ("Die bösartige Geschwülste des Kehlkopfes," Wiesbaden, 1897) states that up to 1881¹ thirty cases had been operated upon with seventeen deaths, a mortality of 56.7 per cent., and that in all the thirty there was only one definitive cure,—that is, in which three years or more had passed without recurrence. Later statistics, fortunately, have proved progressively more favorable. Thus Sendziak (p. 160) tabulated, from 1873–1894, 188 cases of laryngectomy for carcinoma. The results are:

- (1) Recurrence, 32.45 per cent.
- (2) Relative cure (less than three years), 6.9 per cent.
- (3) Definitive cure (three years or more), 5.85 per cent.
- (4) Death, 44.7 per cent.

Schniegelow (*Annales des Maladies de l'Oreille du Larynx*, etc., April, 1897) has tabulated fifty cases of total laryngectomy from 1890 to 1897, and these still later statistics are far more encouraging. His table shows:

- (1) Recurrence 20 per cent, a fall of 12 per cent. from Sendziak's table.
- (2) Relative cure, 48 per cent., a rise of 41 per cent. from Sendziak's table.
- (3) Definitive cure, 10 per cent., nearly double that of Sendziak's table.
- (4) Death, 22 per cent., one-half that of Sendziak's table.

The mortality, it will be observed, therefore, has been halved and the definitive cures doubled, as compared with Sendziak's statistics. Were the cases occurring from 1890 to 1894 excluded from Sendziak's statistics, the relative difference would be even more favorable.

The causes of the mortality are chiefly (a) weakness of the patient by reason of the disease, the poor aëration of the blood, and the entrance of septic discharges from the diseased larynx into the lung before the operation; (b) shock, including hæmorrhage, during the operation; and (c) after the operation, septic pneumonia, due to the aspiration of infected wound fluids. This is the greatest danger of all. The sources

¹ Most German authors entirely ignore the very first case, which was done by Patrick Heron Watson, of Edinburgh, in 1866.

of these wound fluids are twofold; first, the tracheotomy wound, if, as is usual, tracheotomy has been done; and, secondly, the wound left by the removal of the larynx. These wound fluids are usually infected from the food, the secretions of the mouth, and the packing by iodoform gauze which renders primary union impossible.

While the method which I shall describe does not obviate the weakness or any other unfavorable influence from the general condition of the patient prior to operation, it minimizes the other causes of death, and especially the possibility of pneumonia.

I cannot claim originality for any one of the steps, for they have all been employed, I believe, by others. Thus Bardenheuer (*Archiv für klinische Chirurgie*, 1891, xli, 561) closed the communication between the trachea and the pharynx, but he only kept it closed until the wound became covered with granulations, and complications were no longer to be feared, say fourteen days. The communication was then reopened for the insertion of an artificial larynx. After adopting this method he had had four recoveries, while by the former method he had had four deaths. Cohen united the stump of the trachea to the skin (*Transactions of the Philadelphia County Medical Society*, 1892, xiii, 302), one of the most important improvements in the technique, since it prevents in a large measure the access of wound fluids to the lungs. Other surgeons also have used the Trendelenburg posture, etc. But as a systematically planned operation, combining many advantages, the present technique as a *tout ensemble* may be called original.

(1) The general preparation of the patient is the same as for any other operation.

(2) Preliminary disinfection. As in all cases about the mouth, nose, pharynx, and larynx, I am particularly careful to make a systematic attempt for two or three days beforehand, to secure at least partial disinfection. While partial disinfection is not as good as complete, yet the results in the treatment of fractures of the base of the skull, in the extirpation of rectal tumors, etc., shows its great value.

I have the teeth very carefully cleansed by the tooth-brush. If there are any old stumps of teeth present it is better that they should be extracted, and the operation deferred a few days until these dental wounds heal. For two or three days before operation every two hours, when the patient is awake, I have the mouth and each nostril sprayed separately with a solution of boric acid, listerine, or both.

(3) Tracheotomy. Nearly all authors recommend a tracheotomy either as the first step of the operation or more frequently ten to fourteen days before operation. In the few cases in which dyspnoea is great I should be disposed to do a tracheotomy, say two weeks before the laryngectomy; not, however, with a view of preventing the entrance of blood and wound fluids into the lungs by the introduction of a tampon canula, but for the purpose of improving the general condition of the patient. In the case which is the basis of this paper I did a tracheotomy at the time of operation, but removed the tracheal tube at the termination of the laryngectomy, immediately closed the wound in the trachea, and obtained absolutely primary union. In any future case I am strongly of opinion that it will be better to omit tracheotomy entirely. As I shall show it is not, in my opinion, needful, and by omitting it we would eliminate one cause of septic pneumonia.

(4) Posture. The entire operation, after the trachea is invaded, is done with the patient in the Trendelenburg position. I am quite persuaded that the majority of surgeons do not appreciate to its full the advantages which this posture possesses in all operations about the upper air-passages. As I have pointed out in a previous paper (*ANNALS OF SURGERY*, July, 1897), I employ it in epithelioma of the lip, in extirpation, or other operations on the upper and lower jaw, in removal of the tongue, in cleft palate, in operations on the tonsils and pharynx, and all similar operations. Blood will not run up hill any more than water, hence, if we employ this posture in laryngectomy, we avoid one of the chief reasons for tracheotomy and the employment of a tampon canula.

The disadvantages of a tampon canula are very great. Kocher also has lately dispensed with them entirely (Rutsch,

loc. cit., p. 489). The three most commonly used are those of Trendelenburg, Hahn, and Gerster. Of the three Gerster's is distinctly, in my opinion, the best. It can be more accurately adapted to larynxes of varying sizes, and is much less likely to injure the parts either by undue pressure or by difficulty of introduction. In one case, in my attempts to introduce a Hahn canula, the rings of the trachea were considerably torn. The objections to Trendelenburg's canula are arrest of respiration, which sometimes follows its introduction, the production of pressure gangrene in the trachea, obstruction to the lower end of the tube by the rubber ballooning into the trachea beneath it, the bursting of the rubber or its being cut, and if none of these mishaps occur, the air often gradually escapes, and thus renders it useless.

The Hahn canula cannot be made aseptic so easily as the others; and as Lennox Browne has pointed out, it requires sometimes twenty minutes for the expansion of the sponge, after its introduction.

(5) *Anæsthesia.* This is done at first through the mouth, and is so continued until the larynx or trachea is invaded. A large tracheotomy canula (twelve millimetres in diameter) is then introduced, and held in place by disinfected tapes tied around the neck. The inner tube of this canula is removed and the metal tube of a Hahn canula, which precisely fits it, is introduced. A rubber tube connects this with the ordinary funnel for the administration of chloroform.

(6) *The operation proper.* I shall describe the operation in connection with the case herewith reported, and then shall indicate the improvement in technique, which I purpose adopting in the next case I may have.

(7) *The after-treatment.*

(a) *Posture.*—The patient is kept in the Trendelenburg position by placing a chair under the foot of the bed. This posture prevents any wound fluids from running down (or rather up) into the lungs. This position is to be maintained for one day. On the second day the bed is lowered to the horizontal plane. On the third day he is allowed to sit up in bed on a bed-rest; on the fourth to get out of bed and sit

out of bed and sit in a reclining chair; and on the fifth day he may walk about the room.

(b) *Food*.—For two days nutritive enemata only are to be used. After that a teaspoonful of liquid food is given, at first every half hour, always followed by a tablespoonful of sterile water to wash away any food that might possibly leak into the laryngeal wound. At the end of a week full diet as to quantity may be given, but no solid food is to be given until the tenth day. No catheter or oesophageal tube is required. The present patient could swallow from the very first.

(c) *Dressing*.—The primary dressing will be described in connection with the case. On the day after the operation the small gauze drain is to be removed. Half of the stitches may be taken out on the fourth day, and the remainder on the sixth day. In the case here reported the temperature on the day after the operation rose to 101.8° F., and fluctuated between the normal and 101° for a week, when it fell to the normal.

(8) Objections.

The only objection to this method which occurs to me is that it absolutely precludes the use of any artificial larynx. But the possession of voice is nothing when compared with a speedy recovery and a greatly diminished danger of a fatal result. Rutsch (*loc. cit.*, 485) believes such a larynx is very unsatisfactory.

Of course, I recognize the fact that one case does not prove the value of any method, but its advantages were so striking in this case that, as laryngectomy is a relatively rare operation, I have not thought it best to wait until I could accumulate a much larger experience before bringing it to the attention of the profession.

(9) Final results.

Of course, it is too early yet to draw any inference as to the possibility of recurrence in this particular case; nor is this my purpose. My intention has been rather to demonstrate a method of laryngectomy which would diminish more especially the immediate mortality of the operation and secure speedy recovery by primary union. The chances of recur-

rence are no greater, nor yet any less, after operation by this method than by any other. This particular patient has been able to go out in all weathers during the past extremely severe winter, though living as far north as Waterville, Me., where the thermometer has been many degrees below zero.

He writes me under date of May 1, 1899, that he cannot sing and is not a success as a whistler. As to his voice, he is able to speak loud enough to be heard at a distance of at least twenty feet, provided there is not too much noise. The day he wrote, his wife went into the next room, and, at a distance of twenty-two feet, she understood the following sentence: "The weather seems to be unsettled, but I think that we shall have showers before the day is over," with the exception of the word "unsettled," as to which she was not quite sure. Several other sentences were also well understood. He seldom uses his writing-pad in communicating with members of the family. Strangers do not understand him as readily as those who are accustomed to talk with him. He takes part in reading the Scriptures at family prayers, and sometimes himself leads in prayer.

It was clearly an error to abandon to themselves the silk sutures which attached the trachea to the skin. These were drawn down below the level of the skin and so rendered somewhat inaccessible. They should have been either of slightly chromicized catgut or fine kangaroo tendon, which I think would have been the best. If of silk, they should be removed by means of the laryngeal mirror at the end of a week or ten days. The silk stitches which I left have annoyed him somewhat ever since. When Dr. Freeman examined him, on October 19, no evidence of the stitches was found, but Dr. Bessey removed three on the 24th, another on the 26th, and on November 28 part of a fifth. A small sinus still persists at this point, probably due to a retained portion of the silk suture.

The tracheal tube is only worn at night; he still finds that if it is omitted for any length of time some contraction of the orifice takes place.

His general condition is excellent. His weight, 133

pounds, is normal, and he is in much better health than before the operation.

CASE.—The Rev. Dr. S., aged fifty-nine years, a missionary in Burmah for many years, first consulted me by letter in the early autumn of 1897. He had done a great deal of open-air preaching, naturally causing a great strain on his voice. About five years ago, after an attack of grippe, he observed that his voice at times cracked. A year and a half ago this became more pronounced, and, at the instance of his physician, he refrained from using his voice for six months. After three months' rest it was so much better that he resumed his preaching, only to break down again very soon. About a year before he saw me hoarseness began, and this was the principal feature which then annoyed him. I wrote to him, advising that he should come to this country at once, as I feared he was suffering from a malignant growth. He reached Philadelphia May 16, 1898. On laryngoscopic examination I found a papillomatous growth on the right vocal chord, which, I feared, was the early stage of epithelioma. I sent him to Dr. Walter J. Freeman for examination, May 23. He removed fragments of the growth, which were sent to Dr. D. Brayden Kyle for microscopic examination. Dr. Freeman's report is as follows:

"I found a large, rough growth, occupying all the upper surface of the right vocal chord. It was distinctly epithelial in character, and there was little doubt as to its malignant nature. I removed two pieces with forceps. One piece of the growth was superficial, the other was quite a large piece running well into the growth."

Dr. Kyle's later report is given below. It confirmed the diagnosis of epithelial carcinoma.

First Operation.—Thyrotomy, May 25, 1898. The patient was placed in the Trendelenburg position, which was maintained throughout the entire operation. An incision was made in the middle line, from the hyoid bone to the first ring of the trachea, directly down to the cartilages. After securing every blood-vessel, I divided the thyroid cartilage by a pair of stout scissors precisely in the middle line. The two halves of the cartilage were then held widely apart by retractors. I found that it was not necessary to divide the cricoid, but that I could obtain ample room for manipulation by simple separation of the two halves

of the cartilage. The growth was limited to the right vocal chord, and extended three millimetres below it. I therefore divided the mucous membrane anteriorly and posteriorly by two vertical incisions and by two horizontal incisions, the one above and the other below the vocal chord. I outlined a quadrangular flap down to the cartilage. Beginning then anteriorly this was dissected down to the cartilage itself. Quite free hæmorrhage took place from the divided mucous membrane, which was controlled partly by pressure with iodoform gauze and partly by hot water, which, in the Trendelenburg position, could be used freely. Two vessels were tied. The small fragments of tissue still left attached to the cartilage I curetted away. The right arytenoid cartilage was also removed. The hæmorrhage was so slight at the end of the operation that I closed the laryngeal incision entirely by catgut sutures, through the external soft parts and the perichondrium. When he was placed in bed the pillow and bolster were removed and the foot of the bed was elevated on a chair. He breathed with perfect ease. No food was given by the mouth for twenty-four hours, but four rectal nutritive enemata were administered. On the fourth day his temperature rose to 101.4° F. It then slowly fell to the normal by the fifth day. Slight suppuration took place in the lower portion of the external wound, where a small stitch-abscess developed. He went home June 6, and three weeks afterwards the wound was entirely healed. After this operation Dr. Freeman examined the larynx and reported as follows:

"On the 5th of June I again saw the patient, after the first operation. There was a large ulcerating surface on the right side of the larynx, with considerable swelling of the surrounding mucous membrane, but no trace of the original epithelial growth. The left ventricular band was swollen or rather ballooned out over the chord and concealed it. On making a forcible 'a,' the band collapsed and the chord below it then came into plain view."

Both before he had seen me personally and after he returned to Waterville, Me., which was his home, he was under the care of Dr. Bessey, of that place, and owes very much to his intelligence and skill.

In September, 1898, Dr. Bessey wrote me that a suspicious spot had appeared at the site of the former operation. Accordingly, Dr. S. came to Philadelphia, and Dr. Freeman and I both examined him in October, finding a distinct growth which had

crossed the middle line and invaded the left side. Accordingly, I advised a total laryngectomy.

Second Operation.—Total laryngectomy, October 4, 1898. The patient was placed in the Trendelenburg position, and an incision was made in the median line, in the scar of the old thyrotomy. The thyroid cartilage was again split, and the two halves drawn apart to determine by inspection whether a total or unilateral laryngectomy was required. Having decided upon a total laryngectomy, I dissected away the soft parts from the entire larynx, keeping very close to the cartilages and continued till I reached the œsophagus posteriorly. All hæmorrhage was carefully arrested by catgut ligatures. The median incision in the skin was then carried down nearly to the sternum, but the soft parts were only separated down to the cartilages. A low tracheotomy was now done, but instead of any tampon-canula I inserted a large ordinary tracheotomy-tube, the calibre of the outer tube of which was twelve millimetres in diameter. The inner tube was removed and the metal tube of Hahn's canula was inserted and connected with its chloroform apparatus. Prior to this time chloroform had been administered by the mouth.

The trachea was now divided completely across below the level of the cricoid and below the lower border of the beard. The lower end of the portion to be removed was then drawn forward by a hook, and chiefly by the finger, but, with the occasional assistance of the Allis dissector, I very carefully separated the larynx from the œsophagus up to the upper level of the larynx. By a few snips of the scissors I was then able to divide the attachments of the upper margin of the larynx horizontally and remove it. The epiglottis was drawn down through the median incision and removed. A few vessels were tied with catgut.

The upper edge of the anterior wall of the pharynx was then carefully attached to the tissues, just below the hyoid bone, by interrupted silk sutures, placed very close together. I thus hoped to shut off entirely the secretions of the pharynx and mouth from the operation wound. The upper end of the trachea was now united to the skin by silk suture. The tracheotomy-tube was then withdrawn and chloroform was administered on a pledget of cotton covered with a layer of gauze, held in a pair of ring-forceps over the open end of the trachea. The tracheotomy wound was then immediately closed by catgut sutures to the trachea, and silk-worm-gut sutures closed the corresponding wound in the skin.

The wound above the tracheal opening, at the former site of the larynx, was also closed by silkworm-gut sutures, a small gauze drain being inserted in the lower end. The amount of blood lost during the operation was less than three ounces.

The wound was dressed as follows: Narrow folded strips of gauze were placed above and below the tracheal opening, which was left bare. To protect the wound from infection, if possible, and certainly from dust the body of a disinfected wooden pill-box, from which the top and bottom had been removed, was placed over the tracheal opening, and over the pill-box two or three layers of gauze were laid and pinned to the dressing on each side, the object being to filter the air. From time to time the gauze and pill-box were removed, so as to remove any discharge from the margin of the tracheal opening.

The entire operation of tracheotomy and laryngectomy occupied an hour and a half. At the end of the operation his condition was very satisfactory. He was placed in bed in the Trendelenburg position, without pillow or bolster. The day after the operation the temperature rose to 101.8° F., and for a week fluctuated between the normal and 101° or lower, and then fell definitely to the normal. For twenty-four hours he was kept in the Trendelenburg position. On the second day the bed was placed level, and on the third day he sat up in bed with a bed-rest. On the fourth day he was out of bed. For the first thirty-six hours he was fed by the rectum. After that he took a teaspoonful of liquid food every half hour by the mouth, this being always followed with a tablespoonful of water to wash away any food which might get into the pharyngeal wound, as I was not sure of obtaining primary union at that point. At the end of a week he was on full diet as to quantity, though none of it was solid food. On the tenth day the photograph (Fig. 1) was taken,



FIG. 1.—Ten days after total laryngectomy.

and he was well enough to go home, but as he had to travel between 300 and 400 miles, I thought it best for him to remain for a few days longer, lest any unforeseen complication should arise.

The entire wound united by first intention. The gauze drain in the wound left by the removal of the larynx was removed at the end of twenty-four hours. For the first four days no tube was placed in the upper end of the trachea. Finding by that time that the tracheal opening was contracting, I introduced the tube, but placed it entirely under his own control, so

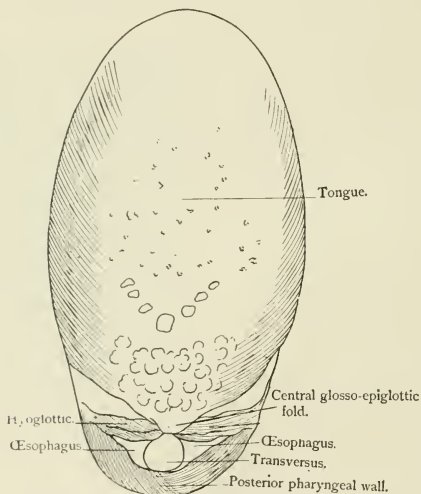


FIG. 2.—Appearance of the parts as seen in the laryngeal mirror after total laryngectomy. (Freeman.)

that he wore it off and on, according to his needs. The skin was somewhat drawn into the opening, showing the need of cutting off the trachea below the level of the beard. The sutures which attached the trachea to the skin were thus drawn slightly into the trachea, but I left them to take care of themselves. This was a mistake, as has been shown.

On October 19, 1898, fifteen days after the operation, he went to Dr. Freeman's office. The following report of the condition, with the accompanying sketch of the appearance of the

parts as seen by the laryngeal mirror (Fig. 2), were made by Dr. Freeman:

"I found Dr. S.'s throat in perfect condition. There is no point of suppuration or ulceration or even of abnormal redness. You asked me to examine especially for extruding sutures. There is nothing of the kind to be seen anywhere. The oropharynx slopes down funnel-shaped in the normal direction, and at the bottom lies a white, round mass, the size of a large marrow-fat pea, which I take to be the contracted transversus muscle. Above this and running from the base of the tongue to the sides of the pharynx are folds, which, I think, we may with propriety call hyoglottic, containing, as they do, fibres of the hyoglossus muscle. Between the inner ends of these lies a projection, the remains of the central glosso-epiglottic fold." (Fig. 2.)

Dr. Kyle's report as to the microscopic findings was as follows:



FIG. 3.—Section of the growth removed before the first operation. (Kyle.)

"Section of papillomatous growth from vocal chord, taken from one of a number of papillomatous projections from a mass involving the right vocal chord and infiltrating the tissue below. This portion was removed by means of a biting-forceps for the purpose of microscopic examination. From all appearances it is papillomatous, but clinically it had the history and appearance of carcinoma. Subsequent laryngectomy proved it to be carcinoma, this tissue being merely a papillomatous projection on the mucous membrane surface of the carcinoma, showing how easily the mistaken diagnosis of papilloma followed by carcinomatous change might be made. (Fig. 3.)

"Sections of the vocal chords, perpendicular to the surface and parallel to its long axis, from the specimen removed at the

laryngectomy, showed a layer of thickened epithelial cells, dense in places and infiltrating the connective tissue beneath, forming small nests. The connective tissue was thickened, as a result of inflammatory infiltration with partial organization. (Fig. 4.)

"The arytenoids showed much the same process, though in a less degree. Some of the smaller portions of tissue from the deeper structure showed no infiltration.

"*Diagnosis.*—Epithelial Carcinoma."

A further improvement can be made in the technique,—viz., the omission of any—even a temporary—tracheotomy. In my next case, after dissecting the soft parts from the larynx and upper trachea back to the œsophagus on both



FIG. 4.—Section of the growth removed by total laryngectomy. (Kyle.)

sides, I shall place the patient in the Trendelenburg position and deepen the narcosis to a slight extent. I shall then divide the trachea transversely, and by three sutures, one in the middle line and one on each side, I shall quickly attach the tracheal stump to the skin. Then I shall introduce the ordinary tracheotomy-tube into the open end of the trachea instead of through a tracheotomy wound and continue the anæsthetic through the tube. The later steps of the operation will be the same as above described. In order not to embarrass the operator, the flange of the tracheotomy-tube should only project at the sides, as the usual wide upper border of the flange would interfere with access to the parts at the beginning of the removal of the larynx.

ON THE SURGICAL ANATOMY OF THE BILE-DUCTS AND A NEW INCISION FOR THEIR EXPOSURE.

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WITH the objects of determining the best method of exposing the bile-tracts for exploration and operative procedures, and for determining the position and relation of the bile-tracts so that operations could be conducted with a minimum of danger to important structures, I recently undertook a series of dissections. In the following paper I shall describe first the incision best adapted for the work, and next the surgical anatomy of the parts involved.

In my early clinical work I made use of the incisions which have heretofore been generally employed. First, the vertical incision along the outer border or through the substance of the rectus; second, the transverse or liver border incision of the Germans; third, the incision made up of an incision along the outer border of the rectus and one joining it at right angles; and, fourth, the incision in the upper half of the linea alba for common duct work.

The objections to these incisions are many. They could be summed up in a few words. These incisions do not give room for extensive work unless they are made very long. When they are made very long, they carry with them the danger of hernia. Every one who has done much common duct work must realize the difficulty of obtaining free access to the operative field through the incisions usually employed, and, in spite of statements to the contrary, hernias after ex-

tensive incisions for bile-tract procedures are not uncommon. No surgeon can tell before opening an abdomen for an operation on the bile-tracts how extensive an operation may be required, and it is therefore desirable to adopt an incision which will be suitable for exploration and simple procedures, and which, at the same time, can be readily extended to meet the demands of the most extensive operation.

The vertical incision along the outer border of the rectus answers very well for cholecystotomy, but does not give sufficient room for bile-duct work unless made very long, and even then the edges of the incision are tense, and much traction is required to expose the field of operation. The result of such extensive incision is to cut off a large part of the nerve-supply of the right rectus muscle, and thus weaken the abdominal wall. The T-shaped incision can be made extensive enough to expose the bile-ducts freely for operative work, but it is the most objectionable incision that can be employed. It is difficult to suture properly. It is difficult to obtain good union at the point where the incisions meet. I have seen necrosis of the sharp corners of the flaps at this point. It is prone to leave a weakened abdominal wall. In my own limited experience I have had three hernias following this form of incision; two after nephrectomies and one after cholechootomy.

The transverse or liver border incision is not as objectionable as the two above mentioned, but it does not meet the requirements as completely as the incision which I shall describe. The incision in the upper part of the linea alba for work on the common duct is objectionable, because it does not give free access to the gall-bladder, and in many cases of common duct work the gall-bladder also requires operative treatment. The problem which was before me in my dissections was to develop an incision which would answer for exploration, and which, in case of need, could be extended sufficiently to obtain free and easy access for the performance of any operation required, and at the same time this incision must impair the integrity of the abdominal wall as little as

possible and carry with it a minimum of danger of subsequent hernia.

The incision which I have introduced, I believe, meets these requirements, and, as it can now be urged both from anatomical grounds and clinical results, I feel warranted in presenting it to the profession as a small but not unimportant contribution to the surgery of the bile-tracts.

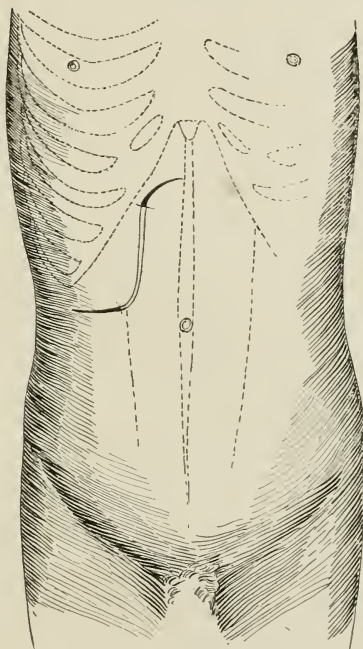


FIG. 1.—New incision for the surgery of the bile-tracts.

My incision should be divided into a primary portion and the extended parts of the incision. The primary part, which can be employed for exploration or simple cholecystotomy, is an italic letter *f*-shaped incision along or through the outer border of the rectus muscle, as shown by the double

line in Fig. 1. This may be made from three to four inches in length. The extended parts of the incision are added to this when required. These extended portions are seen as the heavy line in Fig. 1. These extended portions can be made from an inch to three inches in length as the thickness of the abdominal wall and the character of the operation demand. When complete, the incision furnishes much freer access to the gall-bladder and bile-ducts than can be obtained by any other form of incision. The edges of the incision are readily held apart without tension, and the entire bile-tract is freely exposed for examination and operative procedures. To be properly made, the surgeon should employ a very sharp knife in making this incision. It is not possible to make a clean-curved incision with a dull knife. ✓

Anatomically, the incision for an incision of its length injures a minimum amount of the nerve-supply of the abdominal wall, because, even though the incision is made of great length, the extended parts of the incision run almost parallel with the nerve-supply of the abdominal muscles. (See Fig. 2.) By a division of the rectus in part and of the internal and external oblique and transversalis muscles, the incision can be widely separated without tension. The fact that the incision is in close contact with the costal arch makes resulting hernia improbable, as a cicatrix in the upper part of the abdominal wall does not as readily yield and produce hernia as a cicatrix in the lower portion of the abdominal wall.

The following structures are divided in the incision: Skin, superficial fascia, external oblique muscle and aponeurosis, internal oblique muscle and aponeurosis, transversalis muscle and aponeurosis, rectus muscle, the transversalis fascia, which is here very thin, and the peritoneum. A few of the terminal branches of the intercostal nerves to the rectus are divided, and the anastomosis between the internal mammary and deep epigastric arteries in the substance of the rectus is divided, and usually needs ligating. The incision should not be nearer than three-quarters of an inch to the costal arch.

When the complete incision is made, the following structures can be seen as represented in Fig. 3. The liver and gall-bladder above, the round ligament of the liver and the stom-

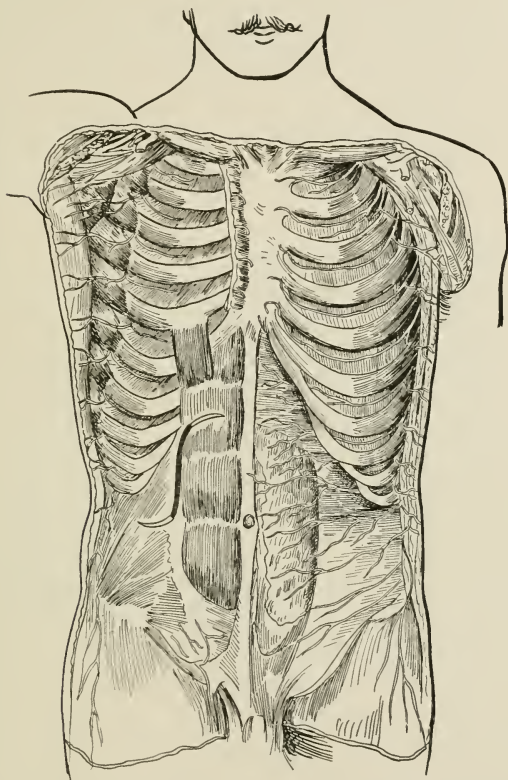


FIG. 2.—Showing relation of incision to the muscles and nerves of the abdominal wall. Note that the extended portion of the incision runs parallel with the nerves.

ach to the left. The duodenum, the transverse colon, and great omentum below. The transverse colon and omentum and duodenum should be pushed downward, the stomach to

the left, and the liver should be held up by the fingers of an assistant. We will then have exposed to full view the gastro-hepatic or lesser omentum, which contains the following structures between its two layers: The portal vein, the hepatic artery, the common, cystic, and hepatic ducts, the gastro-duo-

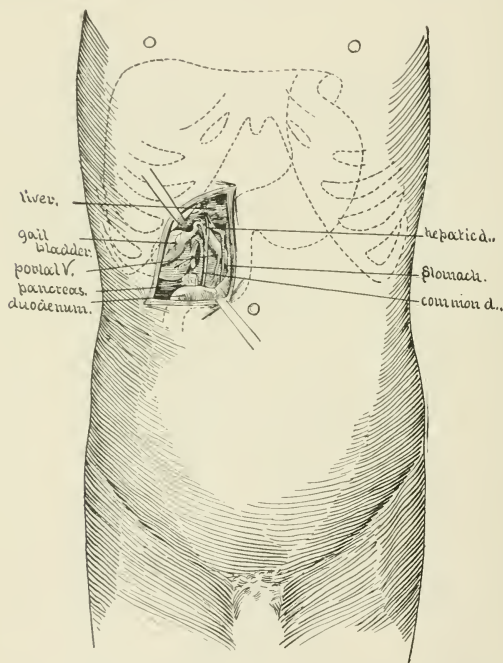


FIG. 3.—Structures exposed by incision, the anterior layer of the lesser omentum removed.

denalis artery and pyloric vein and the cystic artery and vein, the nerve-supply of the liver and the lymphatic vessels and several lymphatic glands. The foramen of Winslow is at the right free edge of the lesser omentum. These structures and their relations are well seen after the anterior layer of the

lesser omentum has been removed, in Fig. 4. The left index-finger can be passed into the foramen of Winslow and the extrahepatic ducts palpated throughout their extent except the portion of the common duct covered by the pancreas.

It must be understood that, as a rule, in operations on the living subject that the normal conditions are altered by adhesions and changes in shape and size of the gall-bladder and bile-ducts, but after the separation of the adhesions the relations will be found practically as here represented.

In closing the incision, silkworm-gut sutures should be

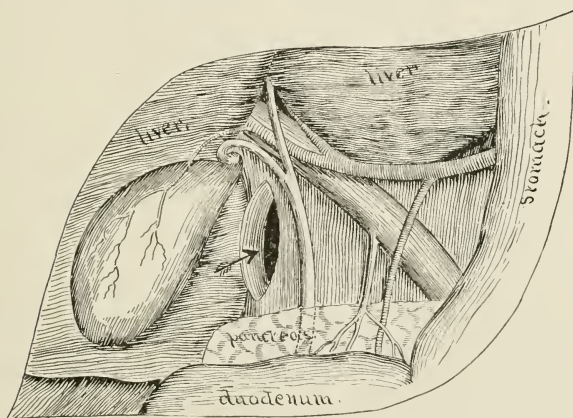


FIG. 4.—Normal structures seen through incision, the anterior layer of the lesser omentum removed.

passed through the entire wall, the margins of the wound approximated, and then, before the silkworm-gut sutures are tied, the abdominal muscles and aponeurosis are sutured accurately with buried catgut. After tying the silkworm-gut sutures the skin should be approximated carefully by a continuous horsehair suture.

I believe that the incision which I here present is based upon good anatomical and surgical grounds, and that its adoption will be a step in advance in the surgery of the bile-

tracts. It makes better work possible by giving freer access to the field of operation; it will enable the surgeon to work more rapidly, and in some of the prolonged operations on the bile-ducts this is a vital point. It will reduce to a minimum the dangers of hernia after these operations. It can be employed in all cases, in exploration, limited or extensive operations.

The gall-bladder usually projects below the costal arch

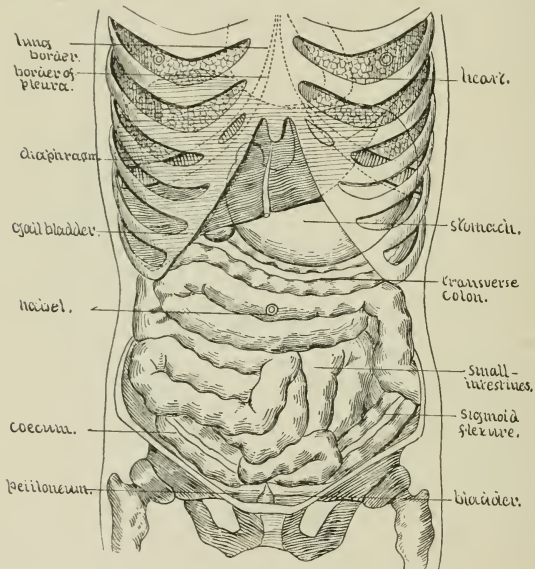


FIG. 5.—Position of abdominal viscera. (Joessel.)

and touches the anterior abdominal wall about opposite the ninth rib (Fig. 5), or better for surgical purposes, the junction of the outer border of the rectus muscle with the costal arch. It varies, however, greatly in position. It is about an inch and a half in width, from three to four inches long, and has a capacity of from an ounce to an ounce and a half. As a rule, the fundus and under surface are covered by peritoneum, and the greater part of the upper surface lies in the

fissure of the liver, separated and connected to the liver by connective tissue. Sometimes a fairly distinct mesentery is found suspending the gall-bladder from the under surface of the liver. The under surface of the gall-bladder rests upon, first, the transverse colon, then the duodenum, and sometimes the pyloric end of the stomach. The fundus is directed downward, forward, and to the right; the neck is directed upward, backward, and to the left. The neck of the gall-bladder presents an S-shaped curve where it joins the cystic duct. An interesting point which was made clear by my dissections was the fact that this S-shaped curve could easily be straightened out by a division of the peritoneum and connective tissue covering the neck of the gall-bladder and the cystic duct, and this explained how this same disappearance of the S-shaped curve is sometimes produced by the passage of a stone through the cystic duct, the existence of this S-shaped curve and of Heister's valves (Fig. 6) explains why a sound cannot, except under such pathological conditions, be passed from the gall-bladder into the cystic and common ducts. The gall-bladder is quite vascular, and receives its main arterial supply from the cystic branch of the hepatic artery, which lies usually behind the hepatic duct, crosses the space between the hepatic and cystic duct to reach the cystic duct and the under and left aspect of the gall-bladder. It sometimes lies in front of the common and cystic ducts in a position where it could be injured in a choledochotomy. In cholecystectomy this vessel is included in the ligature of the cystic duct.

Several theories have been advanced in regard to the gall-bladder which deserve mention. The generally accepted view is that it acts as a reservoir for bile. Murphy has advanced the idea that its purpose is to regulate bile-pressure in the liver and ducts. Langenbuch has recently advanced the view that the gall-bladder is like the appendix, a rudimentary structure, being the remains of one part of an original double bile-tract system. This does not agree with the present views of embryologists, however. The cystic duct is an inch and a half in length, it runs downward, and to the left, between the

layers of the lesser omentum to join the common hepatic. It is the narrowest of the bile-ducts, being about one-eighth of an inch in width. The mucous membrane is so arranged as to produce a screw-like series of valves, called the valves of Heister. The hepatic duct is about two inches in length, it runs downward and to the right, in front of the portal vein, with the hepatic artery to the left. It is about one-sixth of an inch in diameter. In this connection I wish to refer to

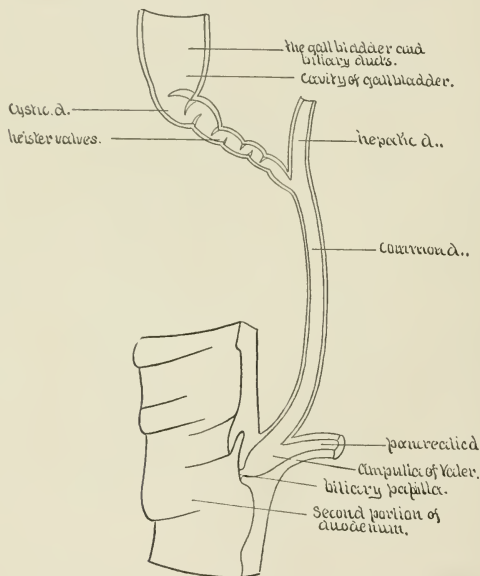


FIG. 6.—Profile view of bile-tracts.

an error which Fenger has made in the description of the surgical anatomy of the bile-tracts. He describes the portal vein as being in front of the hepatic duct, and as covering the upper part of the common duct. I have not found this in any of my dissections, nor have my assistants found this arrangement in any of our extensive dissecting-room material during the last two years, nor is this relation noted

in any of the anatomical works to which I have had access. The few cases in which hepaticolithotomy has been performed also negative this position. Coming from such a careful observer, I am inclined to believe that his dissection must have been taken from a rare anomaly, or was drawn from the structures displaced after removal from the body. As the point is an important one, and as Fenger's description has been frequently quoted and copied, I feel warranted in correcting this mistake.

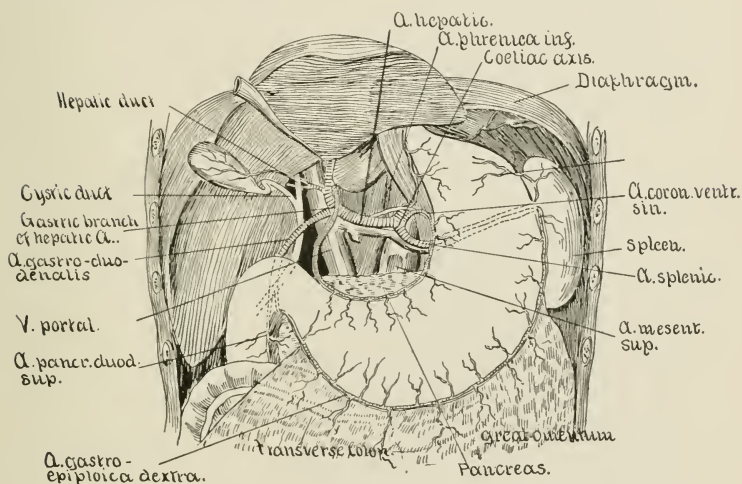


FIG. 7.—Normal anatomy of the bile-tracts and surrounding structures. (Joessel.)

The common duct is three inches in length and one-quarter of an inch in width. It extends from the junction of the cystic and hepatic downward and slightly to the right, between the folds of the lesser omentum through or to the right of the head of the pancreas, passes obliquely for three-quarters of an inch through the walls of the duodenum, and empties into the duodenum four inches from the pylorus. (Fig. 7.) The pancreatic duct empties into the common duct just before its termination, and at this point a slight enlarge-

ment, not easily noted, called the ampulla of Vater, is described. The opening of the common duct is distinctly smaller and marked on the surface of the duodenum by a papilla, which is found with difficulty.

Coats of bile-tracts are: Mucous, muscular, fibrous. These coats are distinct in the gall-bladder. In the ducts the muscular coat is present, but not well marked.

With the finger in the foramen of Winslow (Fig. 8), the cystic, the common hepatic, and the common duct, uncovered

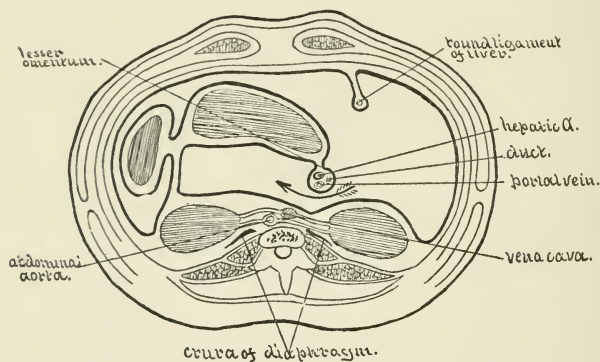


FIG. 8.—Transverse section of body through the foramen of Winslow, arrow in foramen.

by pancreas, can be palpated and incised and stone removed from them, without injury to important structures, the portal vein and hepatic artery being behind and to the left. The position of the gastro-duodenalis artery and corresponding veins from the pylorus, pancreas, and duodenum, and the cystic artery and vein, are to be carefully studied, as from their position I am inclined to believe that injury to them has been the source of the serious hæmorrhages reported in common duct work. The relation of the lower part of the common duct to the duodenum should be noted, as advantage may be taken of a transduodenal route to remove stone in the ampulla of Vater.

An interesting fact is the frequent large size of the lymphatic glands in the lesser omentum. One small gland is found at times in the S-shaped curve at junction of the gall-bladder and cystic duct. These have been mistaken for stone, and, as already cited, they may produce obstruction of the common duct. My dissections showed the large size of the nerves of the liver which run from the semilunar ganglion and pneumogastric, through the layers of the lesser omentum to the transverse fissure. These nerves run parallel with the portal vein, many of them are as large as an intercostal nerve, they can be avoided by making all incisions parallel to the course of the bile-ducts. I have been unable to ascertain what results would follow injury of these hepatic nerves, as I can find no literature on the subject. Experimental research in this direction would be of interest.

A COMPARISON OF THE MERITS OF SUPRAPUBIC AND PERINEAL CYSTOTOMY.¹

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I SHALL endeavor in the following paper to estimate the relative advantages of the suprapubic and perineal routes in the various conditions for which the bladder must be opened, and seek to determine whether the now fashionable high operation has not made us over-estimate the value of the former, and led us to under-estimate the advantages of the latter.

The great expansion of the surgery of the urinary apparatus in man is not the least interesting of the advances made during the present generation, and the wider field now offered for interference has naturally brought to the front new methods and led to the expansion of older ones to meet the requirements of our bolder attitude in approaching the relief of these affections. It may be well to recall at the outset—though the history is so recent that it is well known—the conditions which have led to the present prominence of the suprapubic operation.

The publication of the anatomical studies of Garson, in 1878, showing the relation which exists between that portion of the anterior wall of the distended bladder uncovered by peritoneum and the abdominal wall,—when at the same time the rectum is distended,—and the paper of Petersen, in 1880, showing the application of these facts to suprapubic cystotomy, are the well-defined dates for the new departure in bladder surgery. The recent expansion of peritoneal surgery

¹ Read before the Philadelphia Academy of Surgery, April 3, 1899.

in which the abdominal wall had been so freely and safely incised, and which had shown how fully the dangers from peritonitis could be discounted, undoubtedly had a determining effect in influencing the immediate general adoption of the high operation. The facility with which the operation could be performed, and the satisfactory access which it gave to the bladder,—to both sight and touch,—and the marked extension which it afforded to manipulations within its cavity, all gave a decided impulse to its popularity, and its adoption at once widened out the field of operative activity in vesical surgery.

The natural limitations of perineal cystotomy, the imperfect manner in which it afforded an opportunity for exploring the bladder, and the restricted limits which it placed upon manipulation for the removal of foreign bodies, or morbid growths, were all additional arguments for the adoption of another method and another route by which the much-desired freer access to this region could be obtained.

Cystotomy up to the time of Petersen's paper had been confined to the extraction of stone, the occasional removal of an outgrowth from prostate and base of bladder, or for puncture for retention, and the new method at once afforded an opportunity for expansion in operative interference,—an opportunity which operators were not slow to improve,—and it was natural and proper, indeed, it was inevitable, that it should be pushed to its utmost limits.

Tumors were at once removed, and the prostate was attacked in a manner unheard of before, and at the same time it was applied by many in place of the better known forms of perineal lithotomy for the removal of stones,—large and small,—and in young and old alike, and became a favorite method of dealing with obstruction, needing temporary or permanent drainage.

The history of suprapubic cystotomy is of interest, showing as it does such a varying degree of popularity, from time to time, since its introduction by Franco, in 1556. It has been taken up and its advantages advocated by individual

surgeons, without, however, securing any general adoption until the present. Cheselden practised it with success for a time, and then, without any definite reason being assigned, turned to lateral lithotomy, which he continued to employ until his death.

During the early part of this century the high operation for stone had strong advocates in France,—Dupuytren, Scarpa, and Soubrierbeille being among those who championed its cause,—and proclaimed its merits, without, however, commanding a general following in their own or foreign countries, though here and there it was adopted in isolated cases of very large stones, or for the removal of foreign bodies.

It is of interest in this connection to recall the paper of Dr. Dulles, in 1875, setting forth the advantages of the high operation from the analysis of nearly 500 cases collected from various records. A comparison of the perineal and suprapubic routes to the bladder reveal dangers and difficulties in both, though in both it may be said that they are the exception. In both the condition of the kidneys dominates and controls largely the mortality, and determines the degree and intensity of operative shock. Hæmorrhage may be encountered in both, but is seldom serious or difficult to control in either.

The possible injury and occlusion of the ejaculatory ducts and the wounding of the rectum are peculiar to the perineal operations. The published facts bearing on the first subject are, however, extremely limited in number, while wounding of the rectum rarely occurs, and when it does occur is seldom of serious import.

On the other hand, the much-feared danger of infiltration of urine after opening the prevesical space in the suprapubic operation can be safely ignored, and the danger of peritonitis, while by no means absent, can usually be provided against even when the cavity is opened by accident, or intentionally.

It may be said that there is now among surgeons a practical unanimity as to the best method of performing both median and lateral perineal cystotomy, and that there is no

further room for discussion on this score. On the other hand, the best method of performing the high operation is still the subject of animated discussion, and new suggestions are constantly being made for the improvement of the technique of every step.

The usual median incision of the abdominal wall and bladder has been supplemented by the transverse incision of one or both of these structures. The distention of the rectum by the rubber bag, considered essential by Petersen and his followers, has been discarded by many as dangerous on account of rupture, and the Trendelenburg position adopted as safer and as answering in every way the same purpose.

The distention of the bladder by water, it is now claimed, is less effective and more dangerous than air distention, which is strongly advocated as the better and safer.

The relative merits of leaving open, or sewing up, the wound in the vesical wall is still undetermined, and both methods have their advocates.

The best manner of draining the bladder is still discussed, and new suggestions are constantly being offered,—whether drainage should take place simply by overflow, by single or double tube, or by a system of siphonage, constant or intermittent. In no step of the entire operation has any single method met with general concurrence and approval, and in every one there is at least one alternative. This in itself is an indication that each of the various methods and modifications leave something to be desired, and is a curious if not a more significant fact in connection with an operation so often performed in the last twenty years as suprapubic cystotomy.

Of the two operations, unexpected difficulties may, I think, be said to be more likely to occur in the suprapubic than in the perineal operation, and statistics I consider certainly prove that the high operation is the more fatal in conditions of like gravity and severity. In successful cases the wound is longer in healing. The patient requires more care and attention, and a permanent fistula is more likely to occur.

and even when healing has once taken place a breaking out again occurs more often than in the perineal operation.

Furthermore, the fixation of the bladder to the abdominal wall is likely to impair the natural concentric contraction of the vesical wall upon the urethral outlet as a centre which is so important to the complete evacuation in the normal bladder. It is this imperfect concentric contraction which is to be charged with the recurrence of residual urine, and cystitis when the natural channel resumes its function after suprapubic cystotomy. The perineal opening is free from this objection.

As Diday says of his own case, in another sense, however, "Dieu fit bien ce qu'il fit."

Nature intended that the urine should escape beneath the pubis in man, and demands a serious price when it becomes necessary to ignore this law.

Auneau has studied in an interesting thesis the immediate and later results of the suprapubic opening. The immediate effect upon the bladder he finds most satisfactory. The purulent urine becomes clear, and the mucous membrane returns to its normal condition. To quote the words of Poncet, the bladder of an old man resumes the condition of youth. The artificial channel, however, preserves the conditions of a fistula, and in no way assumes the function of a urethra. It may be guarded to some extent by the voluntary muscles through which it passes, but the sphincter action of the vesical involuntary muscles which has been claimed is entirely wanting, and this irrespective of the various modifications which have been suggested. The surgeon is not master of the function of the channel he has created. Incontinence is the rule with continuous escape of urine, or possibly the intermittent escape by catheter, or overflow, after a small amount has collected in the bladder. Voluntary control and micturition are the great exception. Continence after suprapubic cystotomy, he says, in the experience of Paris surgeons still remains a myth, and the continuous flow of urine which at first was the

patient's salvation soon becomes the source of the greatest distress.

Drainage is an important factor in nearly all operations upon the bladder. It is indicated for the relief or prevention of cystitis, or to substitute an artificial outlet for the natural channel, which may have become more or less completely, and either temporarily or permanently obstructed, and in cases in which the use of the catheter has become painful and difficult. Cystitis following obstruction is the condition most frequently demanding drainage. "As predisposing causes of cystitis we recognize," to quote from Senn, "such injurious agencies and influences as are concerned in establishing a *locus minoris resistentiæ* in the tissues of the bladder, in which a sufficient number of pathogenic microbes of adequate violence accumulate to produce those tissue-changes which characterize inflammation."

Cystitis is always due to the presence of infecting germs. Micro-organisms may be carried to the bladder by illy cleaned instruments, which may also be the cause of the no less necessary traumatism, or they may gain entrance by the simple extension of a disease process along the natural channels, the urethra being more often responsible than the ureter. The passage of germs by the lymph-channels must also be recognized as a not infrequent cause of infection from adjacent lesions. "The ordinary pyogenic organisms are only capable of producing cystitis in the presence of favorable conditions; certain organisms, however, that possess the power of breaking up urea and extremely virulent cultures of the bacillus coli are exceptions. These need no accessory or predisposing cause. The urobacillus liquefaciens septicus and the staphylococcus pyogenes are two of these."

"Everything that interferes with the circulation through the bladder, or the prostatic portion of the urethra, favors the occurrence of cystitis." (Moullin.)

This explains its frequent occurrence in stricture, and hypertrophy of prostate with its residual urine, and passive congestion of the vesical mucous membrane. Retention

alone will not cause it, even when a large amount of residual urine is habitually retained, but furnishes a soil most favorable for the growth of micro-organisms even when present to a slight degree. Stone will not cause it alone, but the irritation and local traumatism which follow its presence are powerful adjuncts to the action of living organisms.

"In suppurative cystitis the bladder contains myriads of septic organisms which grow and thrive in the urine, and pour their poisonous products into it. If the attack lasts for any length of time, or if the micro-organisms are assisted by the presence of some additional irritant, such as a foreign body or a calculus, they spread through the protecting epithelial layer and involve the wall of the bladder, too." (Moullin.)

The cavity may be distended, the walls flaccid or thin, and perfectly tolerant of large quantities of urine, or the walls may be thickened, and contracted so that the bladder capacity may be reduced to one or two ounces, and intolerant of the smallest amount. The cavity may present a condition of sacculation, pouch-like dilatations extending out between the muscular bundles, quite incapable of emptying themselves. The deep pouch which forms behind the prostate, and below the urethral outlet, is well known.

The reaction of the urine has an important bearing on drainage. In ammoniacal urine the tenacious glairy deposit of pus with the incrustation of the mucous membrane with phosphatic salts presents a condition much more difficult of removal by drainage than acid urine with its lighter flocculent deposit.

Those bladders are most effectively drained in which the cavity retains its natural form and its walls are still able to expel its contents; while the bladders of irregular shape and thickened walls yield much less readily to its influence, and in such, complete restoration of function is less likely to follow. In these cases, however, drainage may establish a painless mode of exit, and by keeping the bladder empty remove the conditions favorable for germ action,—namely, congestion of the mucous membrane, and the liberation of ammonia

from decomposition of urea, and the power of contraction may again return to a bladder which had apparently lost it entirely. In many cases of cystitis the simple removal of the predisposing irritant, such as a stone, or of an obstruction, such as a stricture, may be all that is necessary to remove the morbid state due to infection. The bladder now contracts and expels the germ-laden urine, and the mucous membrane rapidly regains its normal condition. In more advanced cases the same result may be obtained by careful and frequent washing with disinfectants, so as to destroy and remove the morbid germs and their products. "When, however, one has exhausted the large resources of catheterism, when the bladder becomes intolerant, when in spite of injections clear urine is no longer obtained, when the patient begins to be infected, cystotomy finds its indication, and should prove a means of great benefit." (Routier.)

In cystitis following stricture even of high grade, perineal drainage following an external urethrotomy is so eminently successful that the advantage of a suprapubic opening, while it has been suggested, has never been seriously considered.

In hypertrophy of the prostate an opening into the bladder may be demanded for an acute retention which cannot be relieved by the catheter, or the use of the aspirator. It may be called for on account of frequent and painful catheterization, or to prevent or relieve a cystitis, either with or without symptoms of general infection. In these cases the perineal route offers certain definite advantages. It is the operation of least danger, most rapid and easiest of execution. The opening is best placed for drainage at the lowest part of the bladder, and it further, in many cases, affords an opportunity, without in any way increasing the danger, of securing a permanent relief by freely incising the obstructing part of the gland, and so cutting down the floor of the urethra to a level with the lowest part of the bladder, as first suggested by Harrison, and preventing recurrence by keeping a large-sized tube in place during the process of healing. These favorable conditions can only be secured after a suprapubic cystotomy

by an additional prostatectomy, which adds greatly to the severity of the operation. That drainage by a suprapubic opening is not satisfactory is shown by the fact that many operators supplement suprapubic prostatectomy by making a perineal opening just to secure a low-level drain. In this connection the names of Belfield, Keyes, and Cabot may be mentioned. It is of interest here to note the fact that Frere Come in performing suprapubic lithotomy began by a perineal incision through which he introduced the sonde-a-dard, and after completing the operation used the opening for the introduction of a drainage-tube. In acute retention, when repeated aspirations will not afford relief, the same reasoning would apply in giving the preference to the perineal operation.

I would, however, make an exception in favor of those cases of acute retention associated with a large hæmorrhage and coagulation of blood within the vesical cavity. Here, while the catheter may enter the bladder, it is immediately clogged with clot so that evacuation is impossible. In such cases the suprapubic opening affords decided advantages by getting rid, at once, of all the coagula. Here the pressing necessity outweighs the future advantage of the opening in the perineum. It must, however, be admitted that for purposes of exploration of the bladder cavity, the high operation possesses all the advantages, and for this purpose, with the admitted impossibility of always excluding such complications as stone or tumor, in advanced cystitis, it will at times be properly chosen, in order to place us in a position to at once deal with these conditions also if found to exist. Should, however, the case prove to be one for simple drainage, a perineal opening should at once be made in the majority of cases.

Of the relative advantages of a suprapubic or perineal opening in the bladder for permanent drainage, it is difficult to express a definite opinion, from a study of statistics or the expressions of authorities. Both routes have been used with advantage. Hunter McGuire and Poncet have been the chief advocates for the first. McGuire especially has published an

interesting series of cases in which voluntary control of the bladder existed with an opening above the pubis. I have not, however, been able to find the evidence that many others have been equally successful, and many who have tried it have expressed themselves illy satisfied with the result. When the patient is up and about, the opening will leak in the majority of cases, in spite of plugs and pads, and when necessary a rubber urinal is a veritable abomination. The perineal tube, on the other hand, is by no means easily borne; for, while it passes through the prostatic urethra, and is grasped by the muscles which close this channel, and so prevents leakage, it is apt to cause more or less pain and discomfort, both in sitting and walking. Should the time come, however, when the tube can be dispensed with, the comfort of the patient is much greater with the perineal opening, which soon becomes competent, except at the time of the voluntary evacuation of the bladder, while the suprapubic continues to leak, and be a source of annoyance until final closure, which is likely to be indefinitely delayed.

When the bladder must be open on account of obstructed or painful micturition in cases of cancer of the bladder, the high opening presents decided advantages. The growths are most often at the base of the bladder, and a perineal tube is likely to cause hæmorrhage, and the growth is likely to obstruct the opening into the bladder so that reintroduction of the tube becomes difficult. The high operation here presents decided advantage. In tuberculosis of the bladder general and hygienic measures should be given the preference to operative interference. Operation may be called for either to attempt direct treatment of the vesical lesion, or to secure relief from frequent and painful micturition. The suprapubic opening is here the better placed, and offers greater facility for inspection and treatment. I would draw, therefore, the following conclusions, that for the purpose of drainage perineal cystotomy presents advantages over the suprapubic:

(1) Because it drains more efficiently while the patient is in bed, and subjects him to less discomfort,

(2) The perineal wound heals more promptly and with less leakage than the suprapubic, if the tube can be withdrawn.

(3) It is less likely to offer difficulty, and its performance takes less time.

(4) It affords a better opportunity for permanently removing the cause of obstruction, and so securing a permanent relief without increasing in any way the danger.

(5) It is less likely to interfere with the restoration of normal contraction, and is in itself a less dangerous way of opening the bladder.

In cancer of the bladder, tuberculosis, and hæmorrhage, suprapubic cystotomy affords the greater advantage.

In discussing the relative merits of the high and perineal operations for stone, I may at the outset quote with entire approval the sentence with which Thompson opens his treatise on the suprapubic operation: "I think," he says, "that among experienced surgeons there will be little or no dissent from the proposition that the operation of lithotomy at a single sitting is, in fairly experienced hands, that which is best calculated to insure a successful result for nine cases out of ten of stone in the bladder occurring among male adults."

I would be understood, therefore, as considering that the operation of choice for the great majority of cases of stone in the bladder in adults is the crushing operation, and that no form of cutting operation can compare to it in safety and efficiency. Nor am I disposed to consider that organic disease of the kidneys, cystitis, or hypertrophy of the prostate, unless most marked, are to be considered in themselves a contraindication; while the experience of English surgeons in India has so far extended the age limit that children of all ages now may be said to come within its scope. Furthermore, the successful development of perineal lithotomy has so far extended the application of the crushing operation to stones of unusual size that it may be said that few calculi remain which must of necessity be subjected to a cutting operation. There still, however, exists a sufficient diversity of

opinion to furnish an ample opportunity for studying the results of the various forms of lithotomy.

Statistics all seem to prove that the high operation presents a much higher rate of mortality than the perineal, especially lateral lithotomy. This is much more marked in early life than in those over fifty. Barling has studied the results of stone operations in five years, from 1888 to 1892, in "six London and seven provincial hospitals, the majority being medical schools." One hundred and sixty-nine cases of suprapubic in all ages gave a mortality of twenty-six,—or 15.3 per cent.; while lateral lithotomy, with ninety-six cases, was fatal in five,—or less than 5 per cent.

In patients under twenty, the contrast is still more marked. In seventy-nine cases of suprapubic lithotomy, fifteen died,—or 19 per cent. Lateral lithotomy, in sixty-four cases, gave a mortality of 3 per cent.

It is of interest to note that the causes of death in the high operation were given as degeneration of kidneys, peritonitis, septicæmia, cellulitis, and secondary hæmorrhage.

Comparing the results for all cases of stone during these five years, including those submitted to lithotrity, with Thompson's well-known earlier tables, he finds that the latter give a mortality of 12.5 per cent., while the former only 10 per cent., showing a reduction of $2\frac{1}{2}$ per cent., by which the general mortality of stone operations has been lowered in modern times. In children, however, the mortality has actually increased; Thompson showing a mortality of 6 per cent. and Barling's tables 8.4 per cent. This greater mortality is shown to be due to the suprapubic operation, as lithotrity in patients under twenty gave a mortality of only 2 per cent.

These statistics are said to include all of the cases of lithotomy in the above mentioned hospitals. Nearly two-thirds of the entire number were submitted to the high operation. This fact proves that the high mortality in modern cases is not due to the fact that only stones of unusual size were reserved for suprapubic lithotomy, as has so often been

claimed, for there is nothing to indicate that there was any difference in the cases submitted to the two forms of cutting operations. From these figures the conclusion seems inevitable that the high operation in average cases of stone in children furnishes a mortality vastly greater than the perineal operation.

The same relative mortality is further shown in the tables for suprapubic lithotomy given by Watson, in the "Text-Book of Genito-Urinary Surgery."

Two hundred and forty children give a mortality of 12 per cent.; twenty-seven adults give a mortality of 0 per cent.; nineteen old men give a mortality of 42.1 per cent.

The same author gives the mortality for perineal lithotomy as follows:

Three hundred and fifty-five children, a mortality of 3.1 per cent., as against 12 per cent.; seventy-nine adults, a mortality of 7.6 per cent., as against 0 per cent.; nineteen old men, a mortality of 15.7 per cent., as against 42.1 per cent.

The success in stone operations in the hands of the English surgeons in India is so extraordinary that it may be questioned whether their results are applicable to Europe and America.

The most recent statistics, said to be drawn from official sources, have been given by J. A. Cunningham (*British Medical Journal*, August 7, 1887):

Ten thousand and seventy-three cases of lithotrity, with a mortality of 3.96 per cent.; 7201 cases of lateral lithotomy, with a mortality of 11 per cent.; 147 cases of suprapubic, with a mortality of 42 per cent.

It is of interest to speculate on the causes of the unusual success in the crushing operation in India, so far as it is beyond anything found elsewhere.

Freyer asserts that while the average is younger by some years than that given in Thompson's tables, the average size of the stones is larger. Personal dexterity, acquired by unusual experience, may play a certain rôle. It seems not unlikely that a part of this success may be due to the fact that

chloroform seems to be so much safer than in the more northern climates, and, further, to the fact that they are dealing with a population foreign to the use of all forms of alcohol, the habitual use of which is so potent an influence in producing those degenerative changes of the kidneys, and arterial system, which is so important a factor in the mortality rate of all forms of surgical interference with the urinary apparatus in man.

If we are to be guided by mortality tables it would seem to be probable that all forms of cutting operations will be still further restricted, and the cases for which the suprapubic operation is to be chosen should be extremely limited, and I should myself prefer the lateral operation for stones too hard to crush, except in case of very unusual size, from the larger mortality, the increased length of convalescence, the greater discomfort, and greater likelihood of a permanent fistula of the former method. I should myself consider that experience would indicate that the high operation should be confined to stones of most unusual size, to encysted stone, and to stones complicating tumors, and to cases of some deformity, such as ankylosis of the hip, and that hypertrophy of the prostate should only exceptionally demand it.

The operative procedures now offered for the relief of hypertrophy of the prostate present us with a veritable *embarras de choix*. It is not my purpose to discuss the merits of these various methods except so far as the perineal and suprapubic routes are concerned in prostatectomy.

It is essential, however, to refer to castration as a means of relief in these affections. The most recent statistics presented by the author of the operation are to be found in the "Text-Book of Genito-Urinary Diseases." Here are reported 107 recent cases not found in other reports. Of these twelve died,—a mortality of 11 per cent. Two of these deaths it is considered should not be counted, and this reduction would reduce the percentage to 8.5 per cent. The author says that in properly selected cases the death-rate should not be more than 5 per cent. Other authorities have estimated the mor-

tality, however, as high as 20 per cent. Cabot has calculated the percentage of cases decidedly improved as 80 per cent. of those surviving. The operation has been attended with such success that it has commended itself as the method of choice to many surgeons. There are many, however, whose experience would lead them to decidedly limit its application.

The recent reports of the Bottini operation would indicate that it is capable of dealing with a large proportion of cases of hypertrophy in a successful manner, even in the presence of desperate conditions.

In a recent report, by Meyer, in the *New York Medical Record*, 164 cases gave 75.5 per cent. as cured or much improved, with a total death-rate of 8 per cent., or of deaths due to the operation 5 per cent.

These results compare favorably with any of the operations recently advocated and now being tried, and a more extended employment will doubtless soon furnish us with the evidence to determine its advantages, and to fix its limitations.

It is not necessary to describe in detail the conditions of the prostate which cause changes in the bladder demanding relief. "It does not matter," says Moullin, "what part of the prostate is affected. It may be the median or the lateral lobes; it may be all three, or it may be the urethral portion only; wherever it occurs it obstructs the exit of the urine from the bladder and increases its work;" and, "every form interferes with the level of the floor of the bladder."

Operations are undertaken in hypertrophy either to remove the obstacle to urination, or to diminish the obstruction which exists to the introduction of the catheter (Vignard). Prostatectomy has now been submitted to trial by a large number of different surgeons, and the original operation has been variously modified to supply the deficiencies, and avoid the shortcomings of the method first suggested by Bel-field and McGill. Its results have been greatly extolled, but a superficial knowledge only is needed of the cases reported to discover a decided want of unanimity in the expression of

approval and satisfaction. The relief has been far from complete, and the ultimate condition of the patient far from being all that is to be desired.

"So grave is it, and so far from being ideal in the results that it guarantees," says Keyes, "that we hear less of prostatectomy now than formerly. It is not now generally advocated by the Guyon school in France. The tendency there is to return to the catheter with asepsis."

It seems, however, in spite of such criticism, which is by no means isolated, that some form of prostatectomy is likely to remain as an acknowledged surgical procedure in dealing with the graver forms of hypertrophy that have passed beyond the power of the catheter to relieve.

A suprapubic opening has the advantage of giving a full view of obstructing bars, hypertrophied third lobes, and horse-collar overgrowths, and usually permits the removal of all parts presenting on the vesical side. By this means, partial or complete prostatectomy can be performed, though for the latter recent operators have found that they could derive great assistance by a perineal incision in addition.

Removal of a part or the whole of the gland by suprapubic prostatectomy is only effected by extensive laceration of the mucous membrane about the urethral opening, and by leaving exposed to the urine the cavity left by the tissue removed. It has the disadvantage of having the opening badly placed for drainage, and the hæmorrhage encountered has been severe and hard to control. So conspicuous have the defects been that it is now usual to supplement the suprapubic opening by a perineal incision. By this means hæmorrhage can be more easily controlled, and the necessary drainage more readily secured. It further greatly facilitates the removal of the gland by enabling the operator to push it more prominently into the vesical cavity, and so bring it within easy reach from above. This advantage is so decided that the opinion seems growing that partial removal—cutting away, or gouging out presenting portions of the prostate—should only be attempted by the suprapubic opening alone.

In a considerable proportion of cases a fatal result has ensued, and in no inconsiderable number the operation has failed entirely to secure a return of the power of emptying the bladder, while in others again this has been incomplete, with the evil consequences of residual urine and its resulting cystitis. Its mortality has recently been estimated by Cabot at 20 per cent., with marked relief of the symptoms of obstruction in 83 per cent. of those who survived, or 68.4 per cent. of those operated on,—a proportion less than reported as decidedly improved by the Bottini operation. A variety of perineal operations have been suggested for the complete removal of the prostate. Zuckerkandl, Dittel, Nicoll, and Alexander have all suggested different methods. Alexander's operation may be taken as likely to prove the most satisfactory of these. It may be characterized as a perineal operation with a complementary opening of the bladder above to facilitate the manipulation necessary for bringing the prostate within easy reach from below; just as the operation advocated by Belfield, Watson, and others, must be considered a suprapubic operation with the addition of a perineal opening for drainage, and to afford assistance in the removal of the gland from above.

In Alexander's operation the membranous urethra is alone opened, and the mucous membrane at the base of the bladder left entirely undisturbed, while the tube is best placed for drainage.

The opening above affords in addition every opportunity for exploring the bladder for stone or other complication. The results reported by the author indicate a satisfactory success. A sufficient number of cases by different surgeons have not yet been published to enable us to estimate its definite place in the relief of hypertrophy.

From the present trend of opinion it would seem not at all unlikely that, after all, the operation suggested years ago by Harrison may prove to be the most generally applicable for prostatic obstruction. It seems to have held its place in the estimation of surgeons in the face of the newer operations. It is little more than an external urethrotomy. The finger

carried through the prostatic urethra readily guides the knife to the obstructing mass in the middle, and the lobes on either side may be freely incised and a low level urethra secured, in the large majority of cases.

The perineal route would seem to possess certain decided advantages in cases of hypertrophy demanding operation. It affords the best drainage, it secures an easy introduction for the catheter, if further needed, even when it was most difficult before. It has the great advantage that it may be resorted to in extreme cases when drainage is urgently demanded, and is so rapidly completed that prolonged anæsthesia is avoided,—the greatest danger these cases have to encounter.

During the last twenty years the chapter on vesical tumors has been very fully elaborated. Their pathology and symptoms are now well known, and the data upon which their diagnosis can be made is generally recognized, so that it is unnecessary to dwell on this part of the subject. All forms of tumors are likely to be complicated by cystitis, either with or without stone, by which their recognition is often greatly obscured. Medical treatment and palliative injections are not likely to meet with much result.

Operation is indicated either for the removal of the growth or to provide a painless exit to the urine. Pain—and often of the most excruciating character—is one of the most constant symptoms, and obstruction, more or less complete, frequent when the growth is near the orifice of the urethra. Hæmorrhage may threaten life and demand operation for its control.

Perineal cystotomy has had some notable triumphs in dealing with tumors that were situated near the orifice of the urethra. It is, however, at best a haphazard proceeding.

For the removal of a tumor a suprapubic cystotomy is always indicated. The exploration of the bladder is facilitated, and the opening is so placed that the removal of pedunculated tumors is usually easy, and resection of more or less of the wall, if necessary, within reach.

I see little to commend in the very extensive operations involving most of the bladder with transplantation of the ureters. The removal of pedunculated tumors is usually easy and the result satisfactory. The manipulation must, however, often be made by touch alone, as the bladder fills so completely with blood that it is impossible to catch sight of the growth. The finger, however, can usually safely guide the forceps in removal.

Malignant disease most often involves the trigone, and is not infrequently an extension from the prostate. In these cases suffering is often extreme, and a permanent opening will afford great relief. A perineal opening is generally unfortunately placed, and the fungous growth which is likely to follow operation soon interferes with the flow of urine. A drainage-tube is likely to be painful and to provoke hæmorrhage. The suprapubic operation is better placed and of more enduring benefit.

OBSERVATIONS UPON VOLVULUS, WITH RE-
PORT OF THREE CASES SUBMITTED
TO OPERATION.¹

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ALL cases of intestinal obstruction may be divided into acute and chronic, according to the duration of the process; external and internal, according to the position of the site of the obstruction, with reference to the abdominal cavity; and, finally, into those when the obstruction results from "obturation" or occlusion of the gut by foreign body or growth, or when the lumen of the gut is narrowed by tumor-pressure from without.

The manifestations of volvulus are very complex and diversified, owing to the fact that, in any case, an acute or subacute, if not an actually chronic, course may supervene, depending upon the tightness and degree of the torsion, and this same complexity is rendered still more pronounced because, in some cases, symptoms due to obturation may preponderate, while in others, those due to constriction of the gut, may shape the course of the disease. As in every case of internal obstruction, the symptoms are necessarily more obscure than in external obstruction, when examination of the parts outside the abdominal cavity reveals the nature of the difficulty beyond a doubt.

Volvulus is, therefore, a variety of obstruction in which a consideration of its different features, as well as a report of

¹ Read before the New York Surgical Society, February 8, 1899.

clinical cases, may prove of interest to those engaged in the practice of general surgery.

In regard to sex, it may be said to be more common in males than in females, in the ratio of about four to one. It rarely attacks a patient under twenty. It appears to be most common in middle life.

Its cause has always been a matter of conjecture; generally patients give a previous history of constipation; occasionally a history of having eaten articles of food that are not easily digested, as, for example, cherry-pits, grape-seeds, etc.

Anatomical peculiarities in the intestine may further predispose to an attack of this difficulty; thus a short mesenteric attachment to the posterior abdominal wall may bring the extremities of any loop of gut in close proximity, while undue length of this same mesentery may render a rotation of the sections of the corresponding loop upon its mesenteric axis an easy matter.

It is difficult, however, to understand the impetus which inaugurates this movement of rotation. The accumulation of semisolid, partially digested material in the upper segment of a loop simultaneous with an empty condition of its lower portion may cause a reversal of their usual position, and thus bring about a twist through 180 degrees; the continuation of this same movement may result from impetus, derived from the peristaltic activity of adjacent loops of intestine, or unequal peristalsis in the different parts of the muscle wall of the affected loop itself may cause it to describe a form of "version" that will eventually complete the twist to a complete circle or even further, so that possibly a torsion of 720 degrees may take place. This theory—namely, that of unequal peristaltic activity—seems to be substantiated in some cases, when, after reduction of the volvulus, there has been shortly afterwards a tendency to the recurrence of the difficulty, and in one case, reported by Rose, which, twenty-four hours previously, had been reduced by laparotomy, autopsy showed death to have resulted from such a recurrence. At all events, it is an established fact, as demonstrated in one of the

cases herewith reported, that a patient who has had volvulus is liable at some future time to a recurrence of the difficulty.

Beyond the rotation of the gut, the pathological changes in volvulus depend entirely upon the degree to which the twisted portion is deprived of its circulation. In a certain number of cases, the affected loop most frequently in the sigmoid flexure, occasionally in the small intestine, continues to receive sufficient blood to maintain intact its viability; here we have to deal with an obstruction by obturation. In others, the constriction is so intense as to completely shut off the circulation of the gut, and thus render necrosis of the damaged part inevitable. Under these circumstances the affected mucous membrane, being farther removed from its source of blood-supply, suffers earlier and more extensively than the outer coats of the intestine. This naturally results in areas of ulceration, which, once begun, rapidly increase in size from contact with the putrid faecal matter present in the loop, and if the constriction is not relieved, the entire wall becomes necrotic, and perforation with subsequent peritonitis takes place. It is essential to remember that, at the time of operation, the outer serous coat of the gut may be sufficiently viable to warrant its return into the abdominal cavity, and subsequently perforation takes place from the gradual extension outward of the ulcerated area within. If this accident does not occur, subsequent obstruction may develop from the contraction of the cicatricial tissue, by which the healing of the ulcer is accomplished.

In addition to these changes in the gut, that portion of its attached mesentery, distal to the twist, may present areas of ulceration or actual necrosis from the cutting off of its blood-supply.

In those cases of volvulus that prove fatal, with or without operation, autopsy frequently shows the existence of lesions in distant parts of the body, the result of a septic process. In the event of a complicating peritonitis, the cause of these changes is easily understood. It is necessary to emphasize the fact that similar conditions may occur in the ab-

sence of a peritonitis, and under those circumstances the development of, for example, septic pneumonia must be ascribed to the absorption of infectious agents by the necrotic areas of ulceration in the mucous membrane of the gut.

The diagnosis of volvulus is not always easy. The symptoms, of which the patient complains, depend upon the site of the obstruction and the degree of constriction.

In the enteric variety, the ordinary symptoms of obstruction develop rapidly; in the sigmoid, symptoms, somewhat similar, appear slowly. In both situations, the tighter the constriction, the more rapid the onset, and the shorter the duration of the disease, the more intense the pain and discomfort of the patient. On the other hand, in sigmoid volvulus, with moderate constriction, the course of the disease may be so protracted as to resemble one of the chronic forms of obstruction.

The symptoms revealed by the physical examination of the abdomen are more constant in their development and type than those of which the patient complains, and especially in cases where the sigmoid flexure is involved usually render a correct diagnosis of the volvulus possible in its early stages.

In all cases where volvulus is suspected a rectal examination should invariably be made. If the sigmoid is twisted, the introduction of a sufficiently small hand and forearm will detect the obstruction. As this instrument of examination is not usually available, the capacity of the gut below the obstruction should be determined by the injection of water, and by this means it is found that a relatively small amount only can be introduced, and, after being retained for a short time, is more forcibly expelled than normally is the case.

In the rarer enteric variety, the application of this test yields a negative result.

The examination of the abdominal wall is more satisfactory, when conducted after complete anæsthesia has been established. Even before this is done, inspection sometimes reveals a condition of local asymmetry due to the distention of the affected loop. Visible peristalsis is observed in

those cases, when the constriction is not sufficiently intense to deprive the affected part of its blood-supply. In the latter event, this symptom is absent, due in all probability to the paralysis of the nerves which innervate the muscle-fibre of the gut.

By palpation the distended, elastic, and resistant arms of the twisted loop may be mapped out quite accurately on the abdominal wall, especially when muscular relaxation has followed the administration of the anæsthetic. In cases of marked constriction, the paralysis of the affected loops renders them immovable and fixed, so that their position in the abdominal cavity is a constant one. Percussion should be conjoined with auscultation. The area of tympany, thus obtained, corresponds to the position of the elastic, distended loops. Percussion also reveals the presence of fluid in the perineal cavity, provided it be in sufficient quantity to give the usual physical signs. In cases of slight constriction, the peristaltic movements may be heard, and at times their point of maximum intensity localized by the stethoscope. If the constriction is considerable, these adventitious sounds are absent or only slightly developed.

With the advent of peritonitis, the physical signs of this condition render those of the volvulus obscure, inasmuch as the tumefaction, resistance, distention, and pain become general over the entire abdominal cavity.

The treatment of volvulus is both palliative and radical. In a small percentage of cases spontaneous reduction can take place through peristaltic activity alone.

This can also be occasionally accomplished by the effort of the surgeon. For this purpose reduction may be favored by the inversion of the patient. This neutralizes whatever effect gravity may have had in the production of the difficulty.

When the sigmoid is involved, the use of rectal injections may result in reduction. In the case of Dr. Foote, herewith reported, intrarectal manipulation by a diminutive hand failed to untwist the gut. This is a measure, however, that might

easily succeed in those cases in which the volvulus is of recent formation.

Puncture of the gut with a fine needle through the abdominal wall has been recommended by older writers, in the hope that sufficient gas will escape to permit of spontaneous reduction. In several cases, reported in the literature of the subject, the adoption of this treatment resulted in no harm to the patient. In others a peritonitis developed, but whether it was due to the escape of bowel contents through the puncture or to other causes was not mentioned. It is certainly a dangerous mode of treatment, and not to be encouraged, except as a measure to diminish the size of the distended loop, and thereby render reduction by manipulation more easy, only after the abdominal cavity has been opened.

The trial of any palliative measure should not be allowed to consume any considerable length of time, and should be immediately followed, in the event of failure, by laparotomy.

If an accurate diagnosis has been made, the abdominal cavity may be opened in that part immediately overlying the affected loop. If, on the other hand, the diagnosis is uncertain, the median incision is preferable, as it allows a rapid examination of the abdominal contents, an accurate diagnosis of the nature of the difficulty, and, usually, through it the particular method of treatment indicated may be satisfactorily carried out. If the affected loop cannot be easily reached through such an incision, a second lateral one may be quickly made without subjecting the patient to any additional risk, and without causing any great increased weakness of the abdominal wall, in the event of ultimate recovery. This method of procedure is indicated particularly in those cases of volvulus of weeks' duration, which resemble obstruction by obturation, especially carcinoma, and in this latter condition, when the sigmoid is involved, the first evidence of the existence of the trouble not infrequently consists in the development of symptoms of acute obstruction. Two such cases, in fact, have come under the writer's attention in the Presbyterian Hospital of this city during the past year. To distin-

guish accurately between these two conditions is particularly important, because in each group of cases the appropriate treatment is entirely different. In carcinoma an artificial anus gives relief; in volvulus, nine cases, reported in the literature of the subject, so treated, proved fatal without exception. In some of these latter, a lateral incision had been made, the artificial anus established, and the volvulus undiscovered until subsequent autopsy demonstrated its presence.

The failure of enterostomy as a palliative measure in volvulus must be emphasized. Undoubtedly it affords an outlet to the accumulated material above the site of obstruction, provided that peristalsis is sufficiently powerful to empty the cavity of the intestine; on the other hand, the constriction remains undisturbed, the circulation in the twisted gut, therefore, still impeded or entirely cut off, and although it may be deferred for some time, necrosis is inevitable, and must necessarily prove fatal, either from itself or subsequent perforation and peritonitis.

With the opening of the abdominal cavity, it is absolutely essential in every case to accomplish the reduction of the volvulus by manipulation. This should be gently employed, as laceration of the gut at the point where the two limbs cross has taken place during efforts of reduction. In cases of marked distention this procedure may be greatly facilitated by the withdrawal of a portion of the contents of the distended loops through a trocar and canula, the peritoneal cavity being suitably protected. After reduction has been accomplished, this orifice should be closed immediately with Lembert silk sutures. Further treatment depends upon the condition of the intestine; if the gut is viable, the circulation of the affected portion should be gradually re-established; this should be encouraged by the application of hot cloths, and by the flushing out of the colon with warm water through a flexible tube, introduced from below through the rectum.

If the gut proves viable, measures should be taken provided that the general condition of the patient does not con-

trains indicate this procedure—to prevent the recurrence of the volvulus.

To attain this end, the entire sigmoid flexure has been resected with success, the divided ends being brought together by end-to-end anastomosis. In three such cases, reported by Braun (?), one promptly died, one died a month after the operation of septic pneumonia, the peritoneal cavity and sutured gut being found, on autopsy, in a normal condition, and the third recovered. This method of treatment seems ultra-radical and dangerous, when simple measures will accomplish the same purpose. It is always difficult in such cases to determine the exact amount of gut which it is proper to remove, and the divided ends having been at any rate moderately congested before the operation, do not unite with the same degree of certainty as in those cases of resection, where no impairment of circulation has previously existed.

Senn recommends the shortening of the mesosigmoid by passing through it successive rows of sutures. It is doubtful whether this is of any practical utility. There is no doubt but that volvulus occurs when the mesosigmoid is unusually long. It also occurs with equal frequency in those cases when the mesosigmoid is short. In fact, in one case, reported in the literature of the subject, the length of this structure did not exceed two inches.

The best plan of procedure seems to be the passing of interrupted catgut or silk sutures between the serous coat of the gut and the anterior parietal peritoneum. For this purpose the sigmoid may be carried well over to the side in a direction opposite to that travelled by this structure in the production of the volvulus and sutured, but it should not be placed on the stretch, as such action would interfere with the formation of subsequent strong adhesions, as well as with its normal peristaltic movement. In those cases, in which the mesosigmoid is so short that the sigmoid cannot be approximated to the anterior abdominal wall, a similar procedure, suturing the loop to the posterior parietal peritoneum in a corresponding reversal of position, may be adopted with suc-

cess. The abdominal wound is then closed in the usual way. In those cases in which the constriction has caused death of the gut, the necrotic portion should be removed, and the divided ends brought into the angles of the wound to be united subsequently, when the patient's general strength has been restored.

Any endeavor to establish the continuity of the gut at the time of the primary operation should be discouraged, for reasons already stated, as well as for the reason that, if necrosis has actually taken place, the patient will in all probability be in a condition of collapse, and, under these circumstances, the more quickly the operation is terminated, the more likely is it that recovery will take place.

I am greatly indebted to Dr. John Rogers, attending surgeon to the Gouverneur Hospital, for the notes of the following cases:

CASE I.—Male, aged thirty years; native of Austria; tailor; admitted to the hospital July 11, 1897. Patient gives a history of previous constipation. For the past forty-eight hours patient has had no movement of the bowels, and has suffered from marked abdominal pain, and for the past twelve hours attacks of vomiting, increasing in severity. There has been marked prostration.

On admission the general condition of the patient was weak, the pulse rapid (120) and feeble; temperature slightly increased.

Examination of the abdomen showed a condition of localized tympanites and tumefaction in left iliac fossa. There was moderate rigidity; a high rectal enema was easily borne but yielded no result.

Operation by Dr. Rogers, twenty-four hours after admission: Ether. A longitudinal incision, five inches in length, was made in the median line, above and below the umbilicus. On opening the abdomen a small amount of bloody serum was found in the peritoneal cavity, and the small intestines were markedly congested. That part of the ileum adjacent to the cæcum was, however, collapsed. A volvulus was found in the lower part of the ileum, and was easily reduced by manipulation. The vitality of the gut was unimpaired.

The abdominal wall was closed without drainage. The patient reacted well from the anæsthetic.

On the day following the operation, the temperature rose to 103.4° F. and the pulse to 150; afterwards both pulse and temperature gradually returned to normal.

The bowels, assisted by small doses of castor oil, moved forty-eight hours after the operation, and contained considerable blood; similar stools continued to be discharged at regular intervals, the blood decreasing, but persisting for two weeks after the operation. The patient was given milk diet for one week after the operation, then light diet, and at the end of the eleventh day was placed on regular diet.

Primary union was secured throughout the entire wound.

February 1, 1899: The patient has continued in excellent health for the past eighteen months. During that time he has had no evidence of any intestinal disorder.

CASE II.—*Volvulus of the Sigmoid Flexure thrice relieved by Laparotomy*.—Edward Smith, aged twenty-two years, a deaf mute, and a partial idiot, lives in pavilion F with the male idiots on Randall's Island. Nothing further is known of his family or his personal history. His appetite has always been good, and regularity at stool has not been encouraged.

January 28, 1898, the orderly noticed that his abdomen was much distended, and called the attention of the house surgeon to it. There had been no movement of the bowels for several days, and the distention with gas was very great. The abdomen was not tender, but no tumor could be felt. There was no vomiting.

The following day the distention had increased, but there was still no vomiting and no tenderness, and no tumor could be made out. Peristaltic movements could be followed through the thin abdominal wall. No urine having been ejected in twelve hours, a catheter was passed and a small amount of acid urine, having a high color and high specific gravity, was obtained. It was otherwise normal. A high enema was without effect, as was a half ounce of castor oil given that day, and three minims of croton oil given the following day.

January 30, when I first saw the patient, the condition was unchanged. The patient measured forty inches around the waist at the umbilicus. There was no evidence of ascites. By auscultation-percussion it was evident that the bulk of the distention

was due to two large air-sacs, having a different percussion note (seen after incision to be the ascending and descending portions of the sigmoid), while the small intestines could also be made out, crowded into the right lower quadrant of the abdomen. Air injected through the anus with a Davidson syringe did not pass above into the colon. The general condition of the patient was still very good, without fever, and a pulse-rate of 122. The diagnosis of volvulus of the sigmoid flexure was evident, and operation was at once performed.

Under chloroform, a median incision was made below the umbilicus, and the sigmoid was found to be twisted from right to left, so that its lower portion crossed over in front of its upper portion. It was seven inches in diameter, and must have been at least three feet long. When most of the gas had escaped through a trocar, and it had been untwisted and brought out of the abdomen, it followed around the whole circumference of the abdomen as does the normal large intestine.

There was a great quantity of soft fæcal matter above the twist, and the strain from distention had caused an oblique rupture of the peritoneal and a part of the muscular coats, one and one-half inches long. The trocar puncture and the rent were closed with fine silk stitches, the remaining gas and the fæcal matter were squeezed into the rectum, at the same time that they were washed out by an attendant from below. The wound was closed in layers, and healed primarily. During convalescence the patient was troubled with sluggishness of the bowels, and once a month afterwards his abdomen became distended, and a mass was felt in the left iliac fossa. Repeated doses of calomel removed these symptoms.

The abdominal history of this patient was negative from this time until June 6, when he had a return of his former trouble. As he was more closely watched than formerly, the condition was noted in a much earlier stage, and I found him less distended and in better general condition than at the previous operation. One of the members of the house staff, at the time, was a young woman with a very small hand. After the anæsthetic was given she made an attempt, by introducing her hand and forearm into the rectum and sigmoid below the twist, to unwind the volvulus; but the pressure of the gas held the twist so tight that it was impossible to follow the lumen above that point. The plan of the

previous operation was followed, except that the incision was made to the left of the median line. The same twist was found and reduced. A mural abscess formed; otherwise recovery was excellent.

Not quite a year from the time of the first attack Smith showed again the symptoms of volvulus. He received at the hands of the surgeon then on duty prompt treatment in the way of purgatives and large enemata. Several fluid stools were passed, but the distention was only partially relieved, and the tumor remained. Knowing my interest in the patient, Dr. Ford very kindly allowed me to untwist his sigmoid for the third time, the incision for this purpose being made still farther to the left side than before. The bowel, thanks to the successful purgatives, was not nearly as distended as before, and it was not necessary to draw off the gas with a trocar before getting the bowel out of the wound, as had been the case on both other occasions. Moreover, there were adhesions, not only from the previous abdominal incisions, but fresh adhesions about the twist; so that it seemed a favorable time to attempt a radical cure. Of the three possibilities of resection, intestinal anastomosis, and enterorrhaphy, the last was chosen, and an incision was made close to the right anterior superior iliac spine. The sigmoid was drawn across and into this opening, by means of a thread and a probe, and its lower portion was stitched to the parietal peritoneum in such a manner as to leave no slack between that point and the rectum. Both wounds were closed in layers, and a large plaster-of-Paris bandage was put on, so as to prevent any interference with the dressings. Recovery was prompt and uneventful.

Whether this suture will be successful in preventing recurrence of the twist is by no means certain. Judging from the past record, the patient would easily recover from anastomosis, but to resect a sigmoid flexure as large and as long as he possesses would be a formidable undertaking.

CASE III.—G. T.; aged thirty-five years; male; tailor by occupation; April 20, 1896. Past history not obtainable.

Patient was perfectly well on retiring for the night, less than forty-eight hours ago. On the following morning, thirty-six hours ago, while taking a bath, patient felt a sudden sharp pain in the vicinity of the umbilicus, lancinating in character, and so severe that it necessitated his returning to bed. In the recumbent

position the pain persisted, although diminished in intensity. Several hours afterwards the abdomen became perceptibly swollen and tender on pressure. There was no chill or fever, no vomiting, but a most intense nausea.

During the next twenty-four hours these symptoms continued, and vomiting occurred, the vomitus consisting of the contents of the stomach and bile, but containing no blood. The patient had no movement of the bowels.

Examination, thirty-six hours after the attack, revealed the following condition: Patient in a condition of great shock; skin cold, pale, and clammy,—the extremities colder than the trunk,—the pulse rapid (140), thready, and very weak. Respiration rapid (45), very shallow, and chiefly thoracic. Cerebrum apathetic, although facial expression showed intense suffering.

Without an anæsthetic an examination of the abdomen was made, found extremely sensitive, especially in the lower right side, and, owing to the general rigidity, no information could be obtained of the condition of its contents. Under ether, this rigidity was most marked in the lower right side of the abdomen, palpation eliciting an almost board-like sensation; the left side, though still very rigid, was more yielding. No distinct tumor could be felt. Percussion gave a tympanitic note.

Operation.—Incision, parallel to the anterior margin of the rectus, three inches in length, extending downward from a point on the line joining umbilicus with the right anterior superior spine.

The tissues were divided until the peritoneal cavity was opened. This contained a considerable amount of bloody serum. The small intestine, coming into view, was congested, swollen, but presented a smooth, shiny appearance. The cæcum, easily exposed, proved normal, the appendix was free from trouble, but the lower part of the ileum was distinctly collapsed and pale in color.

One of the distended loops of the small intestine was then seized, and the finger passed rapidly along the gut in the direction of advancing congestion. At about what proved subsequently to be a distance of six feet from the cæcum, the finger encountered the sharp edge of a tissue fold, passing from below upward and to the right; underneath this passed the loop of intestine, tightly constricted, and resisting all efforts to release it in

every direction. The sharp edge above referred to was found to be the border of the mesosigmoid, the adjacent flexure being twisted through an arc of 360 degrees from left to right. The volvulus was easily reduced by manipulation, and showed no tendency to recur. The constriction of the ileum was immediately relieved.

The circulation in both small and large intestines had not been sufficiently impaired to have brought about a condition of necrosis, and the dark purple color of the gut began to assume its normal aspect. The only evidence of tissue death consisted in a denuded area in the mesosigmoid at the site of the twist. The mesosigmoid was of average length, although its base of attachment was shorter than usually is the case.

The abdominal wound was closed as quickly as possible in the ordinary way, the duration of the entire operation not exceeding twenty-five minutes, and an endeavor was made to combat the shock, from which the patient had suffered since his admission into the hospital. All measures, however, proved unavailing, and the patient died three hours afterwards without any evidence of reaction.

Unfortunately no autopsy was allowed.

This case is of great interest, because of the complication of the volvulus by an obstruction in the small intestine. This rendered the diagnosis uncertain, and, as the symptoms pointed to a perforation of the appendix, an incision was made for the purpose of exposing this organ. As already mentioned, it was found in a normal condition.

The unusual rapidity of the process was probably due to the sharp constriction of the small intestine by the edge of the mesosigmoid, as well as to the fact that this took place in a portion of the ileum at some distance from the cæcum. The patient's pulse at the wrist could scarcely be felt at the beginning of the operation, thirty-six hours after the first symptom of the obstruction had taken place.

The condition found at the time of operation certainly justified this procedure.

INFLAMMATION OF THE BURSA GASTROCNEMIO-SEMIMEMBRANOSA,

WITH A REPORT OF FOUR CASES OF ENLARGEMENT AND
DISTENTION OF THIS BURSA TREATED BY EXCISION.

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INFLAMMATION of the bursa gastrocnemio-semimembranosa is doubtless of frequent occurrence, yet American literature does not appear to furnish any recorded cases. These facts, and the excellent results obtained by the method of treatment adopted in the four cases which form the basis of this paper, have led me to record the clinical features of this lesion, and to describe the details of the operative technique as carried out in the removal of these bursæ.

Anatomical Considerations.—Of the various bursæ situated in the vicinity of the knee-joint the one between the inner head of the gastrocnemius and the tendon of the semimembranosus muscle (the bursa gastrocnemio-semimembranosa) claims a fair share of our attention on account of its constant presence, and from the fact that it furnishes, when distended, a very large percentage of all bursal swellings situated in the popliteal region.

A glance at Fig. 1, drawn from a series of dissections made at the New York Post-Graduate Medical School by the author, will better help the reader to refresh his memory as to the exact location of this bursa than would pages of anatomical description.

Briefly stated, it lies in its normal situation to the inner side of the popliteal region, at the bottom of the so-called "internal popliteal sulcus." This sulcus or depression, which

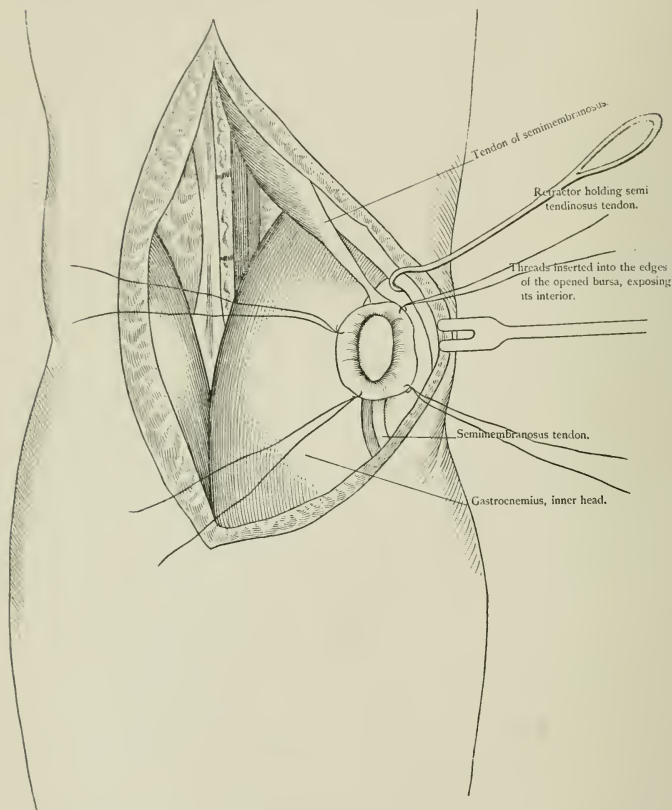


FIG. 1.—The normal bursa between tendon of semimembranosus muscle and tendon of inner head of gastrocnemius muscle.

has for its inner wall the shelving inner head of the gastrocnemius, and for its outer the cord-like mass of the inner hamstring tendons as they cross the back part of the knee-joint,

is best seen and felt when the patient is in the standing posture, with the full body weight borne on the lower extremities; the limiting muscles are thus made to stand out in bold relief, and so deepen this internal popliteal sulcus, at the bottom of which lies the bursa, its centre being about on a level with the upper articular surface of the tibia.

In shape, not unlike a saddle or the letter U, it rests astride the outer and tendinous border of the inner head of the gastrocnemius, at the point where the tendon of the semimembranosus muscle overrides this border on its way to its

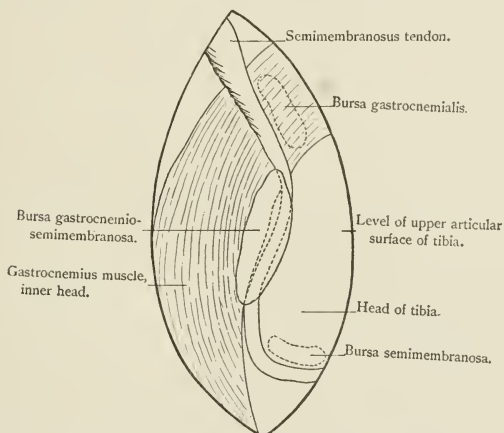


FIG. 2.—Diagram of the bursa connected with the gastrocnemius muscle and with the semimembranosus tendon.

tibial attachment below, one of the limbs of the U resting on the anterior surface, the other on the posterior surface of the gastrocnemius in this position.

It is the only bursa common to these two muscles (gastrocnemius and semimembranosus); the smaller bursa, situated directly above it (the gastrocnemio-condylar bursa, see Fig. 2), being placed between the inner head of the gastrocnemius and the posterior surface of the inner condyle of the femur, the bursa situated directly below it (the bursa semi-

membranosa proper) being placed between the tendon of the semimembranosus muscle and that portion of the posterior surface of the inner tibial head around which the tendon glides as it runs to its bony insertion just below.

Like other bursæ, its inner surfaces are normally everywhere in perfect contact and sufficiently lubricated by the so-called "synovial secretion" so that the apposed connective-tissue planes are both smooth and moist, permitting here, as elsewhere, the necessary gliding motions between adjacent structures without undue friction.

In size this bursa averages one to one and one-half inches in the long axis of the limb, and about three-quarters inch in the transverse. It is not unusual, however, to have it normally of much larger size (Gruber recording a dissection in a normal subject where the measurements were two and three-quarters by three-quarters inches).

Its size seems to correspond fairly closely with the degree of muscular development of the individual; the largest ones observed in my dissections were in extremely well-developed adults.

Though retaining proximately its U or saddle shape in most instances, it is seen to vary somewhat in this particular, being at times multilocular, with the various cavities communicating or occasionally separate from one another. It is not a rare condition to find the two limbs of the U separated from each other by a so-called "diaphragm" of varying thickness, often perforated at or near its middle, allowing more or less free communication between the two portions of which this bursa is composed. Bands are also seen occasionally in the sac crossing from one side to the other.

Normally the thickness of its walls is in the neighborhood of one-thirty-secondth of an inch.

In recent cases of inflammation with distention its walls do not seem to be much thicker than the above; in the chronic case No. 4, however, they were about one-eighth of an inch in thickness.

While consisting often of a closed sac, which has no

communication with the knee-joint, such occasional communication introduces a factor of supreme importance when we consider the various methods of treatment at our disposal for such an inflamed bursa.

Anatomists differ somewhat in their opinions as to the frequency of such communication.

Gruber estimates roughly that one-third of these bursæ communicate normally with the knee-joint, that in children or embryos they never do, in women sometimes, and that such communicating bursæ are usually found in well-developed male adults. Debierre and Poirier agree with the above as to young subjects, Debierre thinking such communication the rule in adults.

While not communicating directly with the knee-joint capsule, this bursa may communicate with the bursa directly above it (the bursa gastrocnemialis proper), which is found almost invariably either to lead into the knee-joint directly, or to have such a thin membrane interposed as would offer little or no resistance to the spread of infection in that direction.

My own dissections in this direction, which have been done principally on adult and middle-aged bodies, agree entirely with the facts as found by Gruber and cited above.

Etiology.—In many of the cases "overaction" of the muscles concerned seems to have been the starting point of the bursitis, such overaction consisting either of prolonged violent action after a period of comparative quiet (as in Case III, where the lad had skated for a long time, the first time he had worn his skates that winter) or of some sudden extreme action (as in Case IV, where the patient tried to save herself in her fall through a broken skylight), the resulting bursitis (not the synovitis of the knee) dating from this occurrence.

In others no distinct history of such an occurrence could be elicited. In such the possibility of a tubercular, rheumatic, or luetic infection should be kept in mind.

Suspecting the latter, we would of course carry out a

thorough course of antisyphilitic treatment before resorting to the methods to be advised later.

Two of the cases here recorded were adult women, the others were boys of nine and eight.

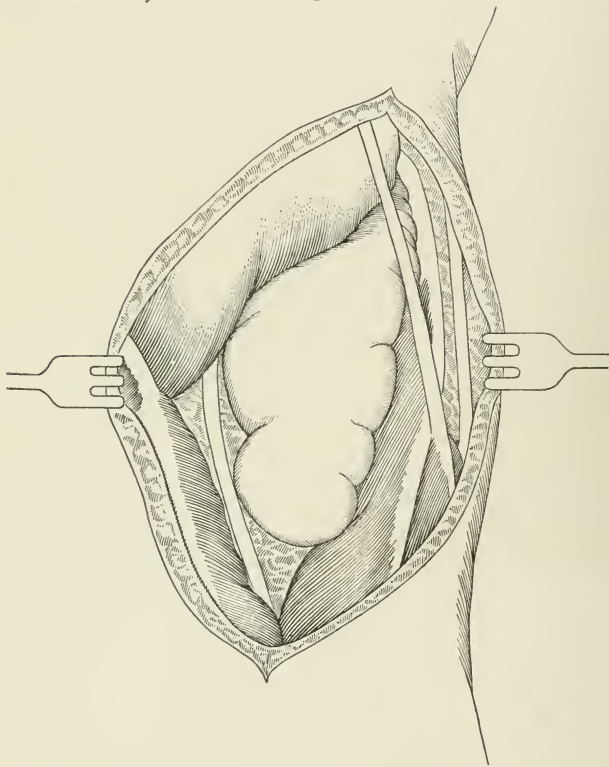


FIG. 3.—Inflammation of the bursa gastrocnemio-semimembranosa.
From a drawing made of Case III.

Signs.—When this bursa becomes enlarged through fluid accumulation in its interior, it follows in its growth the direction of least resistance (upward and inward), and appears first

at the bottom of the internal popliteal sulcus as an oblong cystic swelling. As the bursal contents increase the tumor is seen to project more and more into the popliteal space, until it occupies a large portion of it, the bulk of the swelling being, however, to the inner side. (See Fig. 3 and photograph, Fig. 4.)

A position of hyperextension of the knee causes the tumor to project to its utmost, and its characteristics can best



FIG. 4.—Photograph taken of Case IV after the bursa had been exposed and separated in part from the popliteal fat and from the inner head of the gastrocnemius. The artery clamp points to the bursal cyst as it lies in the internal popliteal sulcus. The inner head of the gastrocnemius shows to its outer side and at the bottom of the wound, with the aponeurotic fibres on its surface.

be studied while the patient is standing in this position. The skin and fatty layers are felt to be freely movable over it (unless these structures have been involved secondarily by a spreading inflammatory process), the tumor itself revealing its origin by a *characteristic sign*, the firm attachment of its base to the cord-like mass of the inner hamstring tendons.

If there exists a free communication between the bursa and the knee-joint, the fluid contents of the bursa can often

be reduced into the joint, the position most favorable for this procedure being one of semiflexion at the knee. This sign, however, is not an absolute one, and should not be relied upon. Such a reduction seemed to have taken place, in part at least, in Case IV, and yet no communication whatever was found to exist between it and the knee-joint or the bursa directly above it.

Absence of this sign should not be taken as indicating that no communication exists, for the bursal contents may be so thick that they cannot readily be forced through a very small existing aperture, or one of the loose fatty bodies, so commonly found in the chronic cases, may block the opening.

Fluctuation can usually be elicited when the tumor has reached an appreciable size. In recent cases, where the sac-wall is thin, this is usually plainly felt, in the chronic ones with a much thickened sac and with almost semisolid contents (consisting in part of the so-called "loose fatty bodies") fluctuation is doubtful or absent. In some cases these movable bodies can be felt. This may happen when the cyst is not specially tense.

When associated with a more or less chronic inflammation of the synovia of the knee-joint (and in these cases probably secondarily to it) we may elicit in addition in the knee-joint itself the signs peculiar to that condition,—crepitation; relaxation with or without thickening of the ligaments, floating patella (if there be joint fluid in excess), stiffness, etc.

Symptoms.—Pain of an acute character seems rarely to have been felt even in the recent cases. The patients complain rather of a sense of discomfort and of pressure to the inner side of the knee and of an inability to move the knee-joint through the arc of usual motion, as in walking, running, climbing stairs, etc. They feel that the knee is weak and show an unwillingness to make any movement which obliges them to put their full body weight on that limb.

When the trouble is localized to this bursa, these are, as a rule, the only symptoms of which the patient complains. When secondary to a more or less chronic synovitis of the

knee, the symptoms referable to the two conditions naturally merge into one another.

Usually at first, when the tumor occupies the internal popliteal sulcus only, but few subjective symptoms are present, and the patient is not aware of its presence; later, as it encroaches upon the popliteal space and interferes with the function of the limb, the swelling is noticed and the patient seeks advice.

Differential Diagnosis: Popliteal Aneurism.—This is, perhaps, the most important lesion from which we should differentiate it. If the bursal swelling be seen at an early period, while still limited to the internal popliteal sulcus, the two conditions could hardly be confounded. Later, when the bursal cyst has crowded itself out of its original and characteristic position and has come to occupy the greater portion of the popliteal space (acquiring thereby, in some cases, a transmitted impulse from the artery upon which it lies) such differentiation can best be made by tracing the cyst to its point of origin, the bottom of the internal popliteal sulcus. It will be found intimately adherent to the tendinous mass of the inner hamstring tendons at this point. This is the most reliable sign. Thrill and pulsation may both be absent, and yet the tumor may be an aneurism. Either aneurism or bursa may present itself as a reducible pulsating tumor.

Lipoma of the Popliteal Region.—Soft fatty masses embedded in loose connective tissue often give rise to what may be described as an indefinite sense of fluctuation. We would not expect to find such a tumor attached to the bottom of the internal popliteal sulcus and to the mass of the inner hamstring tendons.

Abscess.—A cold abscess pointing in the popliteal region might be mistaken for an enlarged bursa; without previous osteocopic symptoms or periosteal changes to guide us the diagnosis might be "*in suspenso*."

Sarcoma.—If arising from any of the tissues in the direct vicinity of this bursa, such a tumor might well present difficulties in differential diagnosis, particularly if of the cystic

variety. If it started from a point above, there would be less likelihood of error.

Inflammation of the Popliteal Bursa, or of any of the other Bursæ situated to the Outer Side of the Knee-Joint.—None of them have the characteristic position of this bursa. A popliteal bursa usually shows itself, when distended, as a deep elastic tumor situated farther down in the calf of the leg.

Distention of the gastrocnemio-condylar bursa alone (see Fig. 2) could hardly be diagnosed, it seems to me, apart from the accompanying knee-joint distention, on account of its deep situation under the gastrocnemial head, and from the fact that, as a rule, it either communicates with the knee-joint by a free opening, or is separated from it by such a delicate membrane that any increase of tension within the bursa would in all probability cause the bursal contents to gain access to the knee-joint. After this the contraction of the gastrocnemius would tend to keep the bursa empty at the expense of the knee-joint capsule.

Distention of the bursa between the semimembranosus tendon and the head of the tibia might present signs very similar to those under consideration. I have not been able to find a recorded case. In none of my dissections have I found this bursa to communicate either with the knee-joint or with the bursa which is under consideration in this paper.

Enlarged bursæ are not infrequently found to coexist in both limbs. In the appended references will be found several cases of double gastrocnemio-semimembranosæ bursæ. This is a point which might help us in a doubtful case to rule out aneurism, sarcoma, lipoma, and abscess.

Treatment.—The following methods have been proposed.

Internal Medication.—No cases of cure by this method are recorded. The previous occurrence of any symptoms suggesting a luetic infection would justify us, of course, in pushing a course of specific treatment for several weeks before resorting to the other methods advised.

A bursitis seen in the secondary stage is usually associated with effusion into the sac; in the tertiary stage there is

gummatous infiltration with production of new connective tissue, giving (as is often seen in the case of the prepatellar bursa) a firm elastic tumor, to which the skin is not attached unless involved secondarily by a spreading inflammation.

Compression (alone), with or without Immobilization of the Knee-Joint either by a Plain or Elastic Bandage.—No cases of cure by these means are recorded.

Compression and Counterirritation.—A. M. Shield records a case of popliteal swelling which was much reduced in size by these means. Granting that the lesion here was an inflammation of this bursa, I would scarcely call this a permanent cure, for from the description the sac-wall could easily be felt after the disappearance of the contents (perhaps into the joint). In recent cases there can certainly be no harm in resorting to this method at first, where time is no object, in the hope of a possible absorption of the fluid contents. The most favorable cases for this method would seem to be those where no communication exists between the interior of the bursa and that of the knee-joint. In old chronic cases, with thickened sac-wall, this method would seem to be a mere waste of time and material.

Aspiration of the Sac (alone).—Whether for diagnosis or for treatment this is at best a dangerous procedure. If done in the most aseptic manner, it would be feasible only in the very recent cases, where the contents are sufficiently watery to be drawn through the needle. In all the four cases reported in this article, it would have required a needle of at least the size of a trocar to have gotten out the semifluid contents, and the loose fatty bodies contained in the sac could only have been removed through an incision. In the English literature on this subject are to be found several references to cases where the introduction of a needle was followed by a synovitis of the knee-joint, the inflammation later becoming purulent, and finally necessitating amputation of the thigh. Owing to the well-known tendencies of inflammatory processes to spread in the connective-tissue layers, when no outlet is provided for the exudation (the minute wound made by

the aspirating needle bringing about such a condition in a marked manner), and to the impossibility in every case, as seen by oft-repeated bacteriological tests, to make the patient's skin absolutely aseptic, such aspiration seems to me to be a procedure entirely unjustifiable, *unless we are prepared to follow it up immediately by an open operation*. It might help us to differentiate between an extensive bursitis with transmitted impulse and an aneurism of the popliteal artery, but even in that case I think it far wiser to establish the diagnosis through an open wound, and then to carry out the procedures necessary for the radical cure of whichever condition presented itself.

Aspiration and the Injection of Irritant Fluids, such as Carbolic Acid, Iodine, etc.—Such procedures are mentioned only to be condemned, on account of a possible and unrecognizable communication between this bursa and the knee-joint. It must also be evident that such an injection, made into any part of the semisolid, "starchy" contents, other than that directly in contact with the cyst-wall would fail to excite the desired adhesive inflammation upon which the cure would depend. This method has also been followed by suppuration of the sac.

Incision of the Sac followed by Packing of the Cavity.—While not open to some of the objections noted in connection with the two last-mentioned procedures, this method is hardly to be recommended, as the operation of choice, for several reasons. If no communication is found to exist with the knee-joint at the time of operation (the most favorable condition for this method), the after-treatment of such a granulating bursa would invariably be a tedious one, and there would always be a chance of a recurrence, necessitating a subsequent and much more difficult operation. If a communication be found with the knee-joint, it would be practically an impossibility to keep such a granulating area aseptic during the length of time required for the healing process to be completed, and a tying off of the opening without a removal of the sac itself would be a much more difficult pro-

cedure than the method about to be recommended,—the ex-gonarthrititis necessitating amputation above the knee.

To tie off the neck of the sac following a simple incision, where a communication is found to exist with the knee-joint, would require quite as deep and extensive a wound as that necessary for the removal of the sac, and would, in my opinion, be a much more difficult procedure.

Excision of the Sac.—This is certainly the operation *par excellence*, and the one which was adopted in all four cases here recorded. It should be the form of treatment for all cases (other than the syphilitic) where we wish to obtain a radical cure, after the method by compression and counter-irritation has failed.

I have been led to describe the operative technique somewhat at length, owing to the fact that in my last two cases (III and IV) I found the methods herein described to be those best adapted to a rapid and thorough dissection of the sac. The four cases were subjected to operation in the operating room of the Presbyterian Hospital Dispensary (Out-Patient Department), under the strictest aseptic precautions. They all united by primary intention, and there was not the slightest evidence in any case of inflammatory complication in the knee-joint or in the neighborhood. When last seen, they were all free from the troubles caused by the presence and growth of the bursæ.

Details of the Operative Technique.—The patient, placed in the recumbent position, is anæsthetized, and the field of operation made as aseptic as possible. The limb is held up vertically for several minutes and an Esmarch rubber bandage applied from the toes to the hip. A heavy elastic rubber band is then put on, compressing the femoral in Scarpa's triangle and the rubber bandage removed. The patient is now turned on the sound side, and the knee held in a position of forced extension by an assistant. The skin incision is made in the long axis of the limb, over the most prominent part of the tumor, curving, however, a little more to the inner side of the knee below so as to be over the origin of the bursa at this

point. The tissues are divided down to the popliteal fascia, and this is severed in the same line as the skin incision, exposing the upper portion of the cyst. It is very important that the various layers overlying the cyst-wall be all divided before dissection of the bursa is undertaken, as otherwise such separation is both tedious and unsatisfactory.

When the cyst wall itself is exposed it shows out in the recent cases as a bluish-green and more or less opalescent ovoid mass, crossed in various places by slender connective-tissue bands, which run off at the sides into the popliteal fat and inner hamstring tendons and below into the thin aponeurotic layer of the inner head of the gastrocnemius (see photograph); in the chronic cases, with thickened walls, it appears of a yellowish white color, due, apparently, to the fat contained in the meshes of its outer covering.

The edges of the wound being effectively retracted, the portion of the bursa occupying the popliteal fossa is carefully dissected away from its fatty surroundings from above downward until that portion is exposed which rests upon the inner head of the gastrocnemius, and is connected by tender fascial bands with the aponeurosis on its surface. In cases where the bursa has attained a moderate size only, encroaching but slightly on the popliteal space, the large blood-vessels and nerves contained in that space are not usually exposed in this dissection; in the cases, however, where the tumor in its growth has gradually filled up most of the popliteal space, crowding its other contents to the outer side, the internal popliteal nerve may be recognized as it courses downward to disappear under the gastrocnemius at the point where the two heads of this muscle unite. The popliteal vessels can be felt in the bottom of the wound, pulsation being absent, however, owing to the compression of the femoral above at this time.

As we proceed still farther downward in our dissection we encounter the attachments of the bursa to the semimembranosus tendon; these should be divided without opening into the tendon sheath, if possible. It is an easier and a much better procedure to carry on the dissection without opening

into the bursal sac until it has been freed from the semi-aponeurotic (superficial) surface of the gastrocnemius, on which it lies in part, and from the upper three-fourths of its attachment to the semimembranosus tendon. This brings the cyst down to a pedicle of moderate size; when we have reached this point it makes the dissection much easier and safer to immediately incise the sac, evacuating its contents with the least possible wound contact, and to explore its inner walls for openings communicating either with the knee-joint or with the bursa directly above (the bursa between the inner gastrocnemial head and the posterior surface of the inner condyle of the femur). Where no such openings are found to exist, the further dissection of the cyst-wall is best carried out by introducing a finger of the left hand into the cavity of the bursa and pulling the remaining pouch over it like a glove finger. In this way we may be sure that we dissect the whole bursal wall with the least damage to the tendinous structures at its origin, and with a minimum risk of opening into the synovia of the knee-joint, from which it is separated often at its deepest portion by a layer of connective tissue, a fraction of an inch only in thickness. Where we make out clearly a joint communication, or where such communication seems probable from the previous signs (it might be so small as to escape detection even with a fine probe), a catgut ligature should be thrown around the pedicle at this point and the sac cut away. If there be found an opening into the bursa above, it is to be similarly treated, on account of the usual communication of this latter bursa with the knee-joint; or such bursa may in turn be dissected out and its opening into the knee-joint also closed. Slight flexion at the knee-joint should facilitate this part of the work, relaxing the gastrocnemial fibres under which this second bursa lies.

The wound should now be thoroughly flushed with hot normal salt solution to float out the loose pieces of fat which have remained in the wound from the popliteal part of the dissection, and such stray germs as may have gained access to it in any way. The rubber band compressing the femoral

is gradually loosened, and after a careful hæmostasis the popliteal fascia is united by a buried catgut suture, the fat and skin being brought together with or without the addition of a small rubber tissue or gauze drain, as indicated. A sterilized gauze dressing is then applied and the limb put up, gently flexed, in a plaster-of-Paris bandage. The subsequent treatment is along the usual post-operative lines. Where the wound has healed aseptically, immobilization can be dispensed with after the fourteenth day, and active movements are to be gradually renewed.

CASE I.—J. M., aged nine years. The boy cannot give an intelligent account of his trouble, he thinks he has had the swelling back of his right knee for two years. He has not much pain in the limb. There is an elastic ovoid tumor, about three by one and a half inches to the inner side of the popliteal region of the right knee, its deep portion attached to the bottom of the internal popliteal sulcus, non-reducible into the knee-joint. No impulse.

Operation, August 3, 1898. The cystic mass was found to be the distended bursa gastrocnemio-semimembranosa. Attempt to remove the bursa without opening into its cavity was not successful, owing to its intimate connection with the aponeurosis on the surface of the inner head of the gastrocnemius; all of the sac was, however, removed. No communication with the knee-joint or with the bursa above. Closure of wound without drainage. Plaster-of-Paris fixation in gently flexed position for two weeks; starch bandage for one week. Primary union.

Pathological Report.—Wall of dense connective tissue like a bursa, with slight inflammatory infiltration. One little spot of calcareous degeneration (G. A. Tuttle).

CASE II.—L. McC., aged twenty-four years. Housework. Patient does not remember to have strained herself in any way. Swelling back of left knee for three months. Pain and inconvenience moderate. There is a swelling to the inner and back part of the left knee very similar to the one described in Case I,—deep attachment in internal popliteal sulcus.

Operation August 17, 1898. Bursa dissected out, but in so doing punctured near its base. Removed entire. No communication with knee-joint or with bursa above. Closure and after-treatment as in Case I. Primary union.

Pathological Report.—Wall of dense fibrous tissue with some inflammatory infiltration. Looks like the wall of a bursa (G. A. Tuttle).

CASE III.—S. B., aged eight years. Parent thinks she noticed swelling back of his right knee after boy had been skating. Swelling subsided (?). Three days ago it returned (?). Pain slight, disability moderate. There is a cystic mass occupying internal popliteal sulcus and most of the popliteal space. Tension slight.

Operation, October 13, 1898. The bursa was found very adherent and its dissection was much facilitated, after its upper two-thirds had been freed, by opening it, introducing the finger as into a glove finger, then separating it from its deep attachments by careful strokes of the scalpel. Closure and after-treatment as in Cases I and II. Primary union.

Pathological Report.—Fibrous connective tissue and adipose showing very slight signs of inflammation (Thacher).

CASE IV.—M. B., aged forty-seven years. Housework. Some time during the winter 1897-98 fell through a skylight, straining right knee. For some time previously had felt pain in that knee and there was some "creaking." June, 1898, noticed lump back of right knee. Lump has gradually increased in size. There is considerable aching, a sense of fulness in knee, and flexion is interfered with to the extent that she has to drag her foot. She cannot put her weight on that leg. There is an ovoid swelling occupying the internal popliteal sulcus and a large part of the popliteal space. Fluctuation and synovial crepitation are distinct in the tumor. The contents *seem* reducible into the knee-joint, there is a slight transmitted impulse. Pulsation in both posterior tibials the same. Over the knee-joint anteriorly there are creaking sounds on motion and when the patella is moved from side to side.

Operation December 20, 1898. The bursal sac was found very much thickened. It contained several "fatty bodies suspended in a thick fluid which looked purulent. Cultures were made from this fluid. The sac was dissected out as in Case III. It was extremely adherent to all parts. A very careful examination failed to reveal any communication whatever either with the knee-joint or with the bursa above. Closure and after-treatment as in the three preceding cases. Primary union.

Pathological Reports.—Culture: No growth (Thacher).
Bursa: Simple inflammation; granulation tissue (Thacher).

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REFERENCES.

- Gruber: Hygrom von enorm: Grösse an der Bursa Genu Mucosa retrocondyloidea interna, *Archiv für Pathologie und Anatomie* (Virchow), 1885, Vol. xcix, p. 489.
- Debierre: *Journal d'Anatomie et Physiologie*, 1888, Vol. xxiv, pp. 361-399.
- Lediard: *Transactions of the Pathological Society of London*, 1890, Vol. xli, p. 231.
- Segond: Kyste synov. de l'extremo sup. de la jambe, *Gazette des Hôpitaux de Paris*, 1886, Vol. lix, p. 669.
- Silcock: *Transactions of the Clinical Society of London*, 1888-89, Vol. xxii, p. 163; *British Medical Journal*, 1888, Vol. i, p. 474; *Lancet*, Vol. ii, 1878, October 28.
- Waterhouse: *Clinical Journal of London*, 1896-97, Vol. ix, p. 317.
- Bond: *Practitioner*, London, 1890, Vol. xlv, p. 440.
- Gribbon: *Lancet*, London, 1885, Vol. i, p. 427.
- Hutton: *British Medical Journal*, 1895, Vol. i, p. 417.
- Shield: *Clinical Medical Journal*, 1897-98, Vol. ii, p. 371.
- Domenéy: *Archiv für Anatomie und Physiologie*, 1897, p. 295.
- Retterer: *Journal de l'Anatomie*, Paris, Mai-Juin, 1896, Vol. xxxii, p. 256.
- Nancrede: *International Encyclopædia of Surgery*, 1895, Vol. vii, p. 395.
- Poirier: *Lancet*, London, 1891, Vol. i, p. 219.
- Adams: *Dublin Journal of Medical Science*, 1840, Vol. xvii, p. 521.
- Gruber: (Transl.) *Differential Diagnosis and Operative Treatment of Bursa Gastrocnemio-Semimembranosa*, 4to, Leipzig, 1846; *Oest. Zeitschrift für praktische Heilkunde*, Jahrgang xv, 1869, Nr. 52, S. 961, Wien; Ueber die Synovialkapsel des Kniegelenkes und über die chirurgische Wichtigkeit der Commun. desselben mit einig. benachbar. Schleimb., *Vierteljahrschrift für die praktische Heilkunde*, Jahrgang ii, Band i, 1845, Prag, S. 98.
- Todd: *Cyclopædia of Anatomy and Physiology*, London, 1839-47, Vol. iii; article about "Abnormal Conditions of the Knee-Joint."
- Baker: *St. Bartholomew's Hospital Reports*, 1877, Vol. xiii, p. 245.
- Ashhurst: *International Encyclopædia of Surgery*, 1895, Vol. viii, p. 395.

THE IMPORTANCE OF BLOOD EXAMINATIONS IN REFERENCE TO GENERAL ANÆS- THETIZATION AND OPERATIVE PROCEDURES.

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ABSOLUTE safety in anæsthesia is the one requirement now necessary to make the science and art of surgery well-nigh perfect.

The modern surgeon, who understands thoroughly and practises aseptic and antiseptic surgery, has no fear of danger arising from an infection of his operation wounds. Yet, is there a surgeon who does not tremble at the thought of the now ever-present uncertainty of the action of anæsthetic vapors; and who does not tremble at the thought that at each operation he is forced to place his trust, his skill, his reputation, in fact, his very professional life into the hands of another,—an anæsthetist,—who is, as is too frequently the case, totally unfitted to assume this most responsible duty?

No person is competent to administer a vapor of such potency as has the power to produce in a living subject a virtual death—a death to all things earthly, separated only from the spiritual by a tiny thread of vital force that may momentarily snap in twain—without a careful training and a knowledge of the physiological and pathological actions of these drugs upon the general economy.

Blood-poisoning was, in the preantiseptic era, the dread of surgical patients. But now that we are enabled to banish this fear from our own minds as well as from those of our patients by the practice of modern methods of technique, we still

have to contend with that dread of the unconscious state produced by the anæsthetic vapors,—that removal from relatives, friends, in fact, everything that is dear to life, and to which the majority feel they may never return.

A solution of the problem of safety in anæsthesia can be attained only in the laboratory, and it is a subject well worthy the attention of our scientific investigators.

What a relief the surgeon would experience; what a weight would be taken from his mind; what a burden of responsibility would be lifted from his shoulders if absolute safety in anæsthesia could be assured.

We would see our cases in the earlier stages before the ravages of disease had undermined the general health. The shrunk and debilitated form, the pain-racked body, the anguished mind of the "last resort," now so familiar a sight, would become but "ghosts and shadows of the past."

The time now required for the performance of many operations would be shortened. Our mortality tables, resulting from surgical procedures, would be lessened. Instead of the procrastination now so much in evidence, the less severe operations, the shorter time required for their performance, the smaller amount of anæsthetic vapor inhaled, with a proportionate decrease in the pathological disturbances created, would all tend to place operative surgery upon a pinnacle of safety to which the afflicted would come early for relief.

The mortality statistics from anæsthetics are inaccurate. While they are interesting and instructive in showing the number of deaths reported by fearless men directly attributed to these drugs, if the cases not reported, those traceable to these agents but attributed to other causes, and the large number of post-operative fatalities due to the poisonous and debilitating influences of these drugs upon the general constitution, were added, they can give us no idea of the high rate of anæsthetic mortality.

It has frequently been a source of wonderment to surgeons, whose aseptic technique is above criticism, that certain wounds became infected, that certain patients succumbed to

a most virulent septicæmia, or that others never rallied from the most trivial operative procedure, succumbing to so-called anæsthetic shock without any apparent reason whatever.

We know that multitudes of micro-organisms of different varieties and pathogenic properties are present normally within our bodies,—a constant menace to our welfare,—which are only biding their time for a moment of lowered resistance, together with a favorable soil for the exertion of their pathogenic properties.

So long as the fixed tissue-cells and the leucocytes are well nourished their vigilance and phagocytic properties remain acute, and the sentry line continues unbroken. But allow this line to become weakened, debilitated from fatigue and insufficient nourishment, or the depressing influences of the anæsthetic vapors, superimposed upon an already devitalized subject, and these once faithful and sturdy defenders fall back and give way before a persistent bacterial invasion.

It is in such cases that these untoward results occur, and had preliminary examinations been made of the power behind the throne, the storehouse of tissue-nourishment, that life-giving fluid,—the blood,—it would have been found deficient in its individual or collective elements,—a warning against the production of general anæsthesia, or the performance of a most trivial surgical operation.

It is as much the duty of the surgeon to prepare his patient for an operation as it is to exercise the greatest skill at his command in its performance. With the exception of those emergency cases that require immediate surgical intervention to save life, the condition rarely presents itself when sufficient time cannot be given to the thorough understanding of our patient's health in general.

Many deaths—from surgical operations and anæsthetics—are believed to be the result of our neglect in employing the means at our command for knowing thoroughly our patient's condition beforehand, and of a non-correction, as far as is possible, of pathological conditions before attempting opera-

tive procedures or the production of general anæsthesia. Our mortality rates are largely made up of those cases in which surgeons operate in the hope of getting that one chance in a thousand against the prospect of the patient's recovery.

This practice is frequently against the better judgment of the operator, and a fatal result can only cast discredit upon him and upon operations of unquestionable value.

It may be argued that in some cases regeneration preliminary to operative procedures is procrastination, and may place certain conditions beyond our reach. By increasing the natural resistance or phagocytic powers of the tissues we put a temporary restraint upon the further rapid advance of the disease; while the reconstruction of a shattered constitution gives us a great advantage in enabling the patient, whose prospects of recovery are thereby enhanced, to withstand better a serious or prolonged operation. In those debilitated cases in which a disease is so far advanced that it is thought dangerous to life to delay, or where there is no reaction to this reconstructive treatment; would it not be better to refrain from operative procedures, classing them among the inoperables, rather than to increase the number of our surgical fatalities, thereby intimidating others upon whom the operation could be performed with safety?

In the blood we have a gauge, the readings of which give us a fairly accurate insight into our patient's general condition. While being of the greatest diagnostic and prognostic value, it acquaints us with conditions operable and inoperable. If the cases are inoperable, so far as the resistance and reactionary powers of the individuals are concerned, it shows us by a regenerative treatment when they become operable or when we should refrain altogether from operative procedures.

Neurasthenics, anæmics, chlorotics, leukæmics, and those of a so-called lymphatic temperament, withstand general anæsthetizations and operations poorly, and in all of these the blood shows marked changes from the normal, which is believed to account for the difficulties and dangers attendant upon operative procedures in these individuals.

No surgeon's armamentarium is complete and no surgical hospital perfect in detail without the instruments necessary for thorough blood examinations.

These examinations should be conducted with as much care as would be exercised in the methods of an aseptic technique or in a dissection among vital parts during the performance of an operation. The ultimate result depends as much upon the correction, as far as is possible, of the abnormalities found at the preliminary examination as upon those obtained by a rigid aseptic technique and the exercise of the greatest operative skill.

That a simple preliminary examination of the heart, lungs, and urine is in itself sufficient grounds for the production of general anæsthesia cannot be too severely condemned. For, as is frequently the case, excuses are made for the employment of one or the other anæsthetic in case an abnormality of not too grave a nature is discovered.

It is imperative that a routine practice of blood-examinations should be instituted by surgeons and by internes of surgical hospitals in conjunction with the methods established, giving us thereby absolute indications for palliative or radical treatment.

The specimen of blood to be examined is taken from the lobe of the ear or finger-tip by a small puncture, after thoroughly washing with soap and hot water, and is then examined for—

- (1) Its specific gravity by Hammerschlag's method.
- (2) Its reaction by the method of Leibreich.
- (3) Its absolute and relative number of red and white corpuscles by the Thoma-Zeiss counter; also the shape, size, and color of the former, and the varieties and staining properties of the latter.
- (4) Its hæmoglobin percentage, as given by the instrument of von Fleischl.

The specific gravity indicates grossly pathological conditions of the blood elements, and gives us a fairly accurate estimate of the hæmoglobin percentage.

The reaction is important, from the fact that individuals whose blood shows a decrease in alkalinity withstand general anæsthetizations and operations poorly.

The number and characteristics of the leucocytes are of the utmost importance from a diagnostic and prognostic stand-point. For, besides influencing to a greater or less extent the production of safe anæsthesia, they also indicate with accuracy when and when not to operate in certain cases, as is shown by the following table:

(1) Infection, mild; resistance, good; small leucocytosis.

(2) Infection, less mild; resistance, less good; moderate leucocytosis.

(3) Infection, severe; resistance, good; very marked leucocytosis.

(4) Infection, severe; resistance, poor; no leucocytosis.¹

The above can, we believe, be surgically interpreted into:

(a) When to employ palliative means of treatment; (b) when to consider operative intervention; (c) when to operate; and (d) when not to operate.

Anæsthesia is believed to be produced by an abstraction of oxygen to a limited degree from oxyhæmoglobin, and the formation of a chemical compound between a portion of this blood element and the anæsthetic vapors.

Oxyhæmoglobin is a compound of great complexity, easily broken up or reduced, hence its susceptibility to deteriorating influences. Its chief peculiarities, according to Yeo, are: "(1) That although it contains a colloid substance, it crystallizes more or less readily in all vertebrates when removed from the stroma of the corpuscles; (2) the considerable amount of iron it contains; (3) the remarkable manner in which it is combined with oxygen to form an unstable compound; and (4) the ease with which it yields its oxygen to the tissues and takes it from the air."

As a partial reduction of oxyhæmoglobin is a normal process, the additional abstraction of oxygen, by anæsthetic vapors, can be physiological only in a limited degree, depend-

¹ Cabot, *Clinical Examination of the Blood*, 1896, p. 106.

ing upon the percentage or reserve fund over and above that required for the performance of its normal duties.

In individuals whose blood presents a hæmoglobin percentage of 50 per cent. or less, the anæsthetic vapor produces quickly an increased pathological condition by a forced abstraction of oxygen from a tissue ill-conditioned to part with it, or, the hæmoglobin percentage being so small, the compound resulting from the anæsthetic vapors controls its ability to take up the requisite amount of oxygen and impart it to the tissues as under normal conditions. Hence, it is not surprising that these individuals show quickly signs of collapse. Besides certain nervous forces, respiration is dependent upon the amount of hæmoglobin contained in the blood, and, if this is reduced beyond a certain limit, respiration must cease. The minimum is apparently 20 per cent. as, in three cases dying of collapse after operation, Mikulicz found only 15 per cent. remaining.

A safe rule to follow is, never produce a general anæsthetization in an individual whose blood shows a hæmoglobin percentage of less than 50 per cent.

The vapors of ether and chloroform have a similar action upon oxyhæmoglobin, although the latter appears to have a more grasping affinity for oxygen, or it more readily forms the obnoxious compound, which is believed to account for its greater danger. If the danger could be absolutely eliminated from the employment of either anæsthetic, we believe the preference would be for chloroform, although each has and will retain certain advantages over the other.

If we take the mark 100 on von Fleischl's hæmometer as indicating the normal percentage of hæmoglobin in healthy blood, a condition much removed from this would be pathological in itself. Practically the percentage may be considered normal above 80 per cent.

From observations in the laboratory and operating theatre, I have demonstrated that safe anæsthesia is dependent upon, first, the percentage of hæmoglobin in the blood before, during, and after anæsthetization; and, second, a nor-

mal or increased number of the polynuclear neutrophiles. Anæsthetic vapors may be inhaled with impunity just so long as the hæmoglobin percentage remains higher than the physiological requirements of the system, and the phagocytic or reactionary powers of the polynuclear neutrophiles are not overcome by the anæsthetic compound.¹ Hence, a so-called physiological dose of an anæsthetic vapor for an individual whose blood shows a hæmoglobin percentage of 80 per cent. would be a pathological dose in the same individual showing a hæmoglobin percentage of 50 per cent. or less. As there is always a certain reduction of oxyhæmoglobin from anæsthetic vapors, the higher the original percentage, the less quickly will the danger line be reached.²

Oligochromæmia, from whatever cause, should invariably be considered as a contraindication for the administration of a general anæsthetic for diagnostic or operative purposes. As this condition is usually dependent upon pathological changes, or is an accompaniment of them, in the formed elements of the blood, the morphology of these must not be overlooked.

If we take five to five and a half millions, and five to eight thousand of the red and white corpuscles respectively, as the normal standard to the cubic millimetre of blood, we have a sufficiently accurate basis upon which to estimate the degree of pathological change.

An absolute decrease in the number of the polynuclear neutrophiles should always be considered a contraindication to operative procedures, even though the hæmoglobin percentage is high, because anæsthetic reaction and post-opera-

¹ Anæsthetic vapors and hæmoglobin produce, by their irritative action, a leucocytosis, which is phagocytic in character. During and subsequent to anæsthesia, the degree of leucocytosis determines the individual's resistance to and reactionary powers from the anæsthetic compound.

² At an altitude of one mile, individuals whose hæmoglobin percentage, at the beginning of anæsthesia, is approximately normal, there is a reduction of from 12 per cent. to 15 per cent. of the normal, from anæsthetics, during the first hour of anæsthesia. The lower the percentage becomes the more rapid is the reduction. Observations should be made during profound anæsthesia, because, after the withdrawal of the anæsthetic, the inhalation of pure atmosphere for a few moments readily regenerates a slightly reduced hæmoglobin.

tive wound-regeneration are greatly diminished. A mild leucocytosis of the polynuclear neutrophiles before, during, and after anæsthesia and operation is desirable, as they combat anæsthetic shock, and facilitate wound-regeneration. A marked increase prior to operation, or a steady rise in the number of these cells after operation, points towards an inflammatory condition and suppurative disturbances, beseeching operative intervention, or the examination of a previous operation wound.

I have noticed that where the hæmoglobin percentage was originally high, but became reduced by long-continued anæsthetization, it can be regenerated to some extent by withdrawing the anæsthetic for a short time while pure atmosphere is inhaled. This, I believe, should be frequently resorted to during prolonged anæsthetization for a few moments at a time, stopping short of approaching consciousness.

The operating room should be supplied with a tank of compressed pure atmosphere, or a similar compound, and placed within easy reach of the anæsthetist, as the atmosphere of small operating rooms quickly becomes deteriorated by the exhalations of many persons, and is, therefore, unsuitable for restorative purposes. The gas should be administered slowly through a large inhaler. During operations there is also a hæmoglobin reduction in proportion to the amount of blood lost. Careful hæmostasis is therefore important.

During a prolonged anæsthesia the blood should be examined for its hæmoglobin percentage, and a polynuclear cell-count made at frequent intervals. The blood may be taken from the wound by sterile instruments, if preferred. If a specimen is taken from this source, care must be taken to exclude blood that has been exposed to the air, but to obtain it directly as it oozes from the vessels. Thus by frequent observations the general condition of the patient is constantly known, and danger may be averted long before the physical signs of impending collapse are manifest. If flagging of the circulation should occur, there is no better stimulant than an intravenous injection or a subcutaneous infusion of normal

salt solution. This tends to neutralize within the blood the anæsthetic poison. Strychnine may be administered in doses of one-twentieth grain. Over-stimulation with this drug should be carefully avoided.

In the light of the above investigations and the conclusions drawn therefrom, it is reasonable to suppose that death from the inhalation of the vapors of ether and chloroform begins primarily in the blood, affecting next the respiration, and finally the heart.

With reference to the therapeutic actions of the various drugs that may be employed in the treatment of the different pathological conditions that may present themselves during a reconstructive period, that which treats of the blood will only receive attention.

We know that iron is a normal ingredient of the oxy-hæmoglobin of the red blood-cell, and its affinity for this substance is great when its normal percentage (0.4, Yeo) is decreased. The chemical relations and affinities of oxyhæmoglobin are, as yet, not fully understood, but it is apparent that the amount of oxygen it contains is dependent upon the amount of iron and manganese present, which regulate its ability to take oxygen from the air, and impart it to the tissues in requisite amounts.

The red blood-cell and hæmoglobin have the power to assimilate only a very limited number of the various iron preparations and convert them to their needs, and, in fact, the large majority of the pharmacopœal iron compounds are directly injurious to the general economy.

Of all the preparations of iron experimented with for increasing the percentage of hæmoglobin and the number of the red blood-cells, it has been found that preparations of iron and manganese are assimilated the most readily and give the quickest results. The manganese is a most valuable adjuvant, as this substance gives off oxygen more readily than iron, hence its ability to acquire a greater amount of oxygen.

This combination is given in suitable doses until the normal or an approximately normal hæmoglobin percentage is

reached, as will be shown by registrations upon a preliminary blood-chart.

In cases where much blood has been lost during an operation, the continuation of this treatment greatly facilitates post-operative hæmoglobin regeneration,—a most important prognostic factor, and one that should never be overlooked.

To recapitulate: Safety in anæsthesia and operative procedures is dependent upon, first, a hæmoglobin percentage over and above that required for the performance of its normal duties; and, second, a normal or increased number of polynuclear neutrophiles.

Under these conditions anæsthesia may be produced, and operative procedures conducted with assurances of perfect safety.

I append a form for a chart to record the results of blood examinations, which will be found convenient for use both in private and in hospital practice.

SURGICAL BLOOD CHART.¹

Name, ... Age, ... Sex, ... Nationality, ...
Ward, ... Date, ...
Disease, ...
Room, ... Date, ...
File No., ... Treatment, ... Result, ...

Year.	Month.	Preliminary.		Operative Hour.	Post-Operative.			Remarks.
	Day.							
Hemoglobin.	110	%						
	100							
	90							
	80							
	70							
	60							
	50							
	40							
	30							
	20							
Erythrocytes.	6,000,000							
	5,000,000							
	4,000,000							
	3,000,000							
	2,000,000							
	1,000,000							
Leucocytes.	500,000							
	250,000							
	100,000							
	90,000							
	80,000							
	70,000							
	60,000							
	50,000							
	40,000							
	30,000							
	20,000							
	10,000							
	5,000							
	4,000							
	3,000							
	2,000							
	1,000							
Sp. Gr.	1080							
	1070							
	1060							
	1050							
	1040							
	1030							
Reaction.	Alkaline.							
	Sl. alkaline.							
	Neutral.							
	Acid.							
	Sl. acid.							

Remarks :

¹ Weekly spaces to be divided into daily squares. Operative column to be divided into six.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, February 8, 1899.

The President, ANDREW J. McCOSH, M.D., in the Chair.

ACTINOMYCOSIS OF CÆCUM.

DR. WILLY MEYER presented a young man, twenty-two years old, who, when he was first taken sick, in May, 1896, presented all the symptoms of a mild attack of appendicitis. Up to October, 1897, he had repeated attacks of the same character, and when Dr. Meyer first saw him, about a month later, he regarded the case as one of chronic appendicitis with much infiltration, and possibly an abscess. The temperature was slightly elevated; there was a good deal of swelling close to Poupart's ligament, and the patient complained of pain on pressure. The ability of the man to walk with ease threw some doubt on the diagnosis of appendicitis.

Operative interference being advised and accepted, an incision was made close to the ligament, over the swelling. This revealed at once a hard, dense, infiltrated mass, peculiar in appearance; on working his way carefully through this, he suddenly opened a cavity from which a slight amount of pus oozed and into which a probe could be introduced for a depth of over six inches. Upon its withdrawal it had a fæcal odor, which led the operator to believe that the opening communicated with the cæcum.

Dr. Meyer said the diagnosis in this case rested between tuberculosis and actinomycosis of the cæcum, with the probabilities in favor of the latter. This opinion was confirmed later by the microscope, the presence of the ray-fungus being easily demonstrated. The patient was at once put on large and increasing doses of potassium iodide, and under this treatment his abdominal fistula closed entirely within fourteen months after the operation, and the patient has since enjoyed excellent health.

Up to the year 1890, actinomycosis of the intestinal tract—in fact, of the intra-abdominal organs—was looked upon as almost invariably fatal. Since then we have learned that potassium iodide will improve or cure this very fatal disease. In a recent article, Prutz has shown that potassium iodide, as such, is not a direct antidote to the actinomyces; it does not influence the ray fungus as such; in fact, the fungus will grow in a culture medium containing the potassium iodide. The drug seems to effect the cure by influencing the tissues surrounding the diseased focus, producing there absorption of necrosis. It certainly is advisable to administer potassium iodide before operating on patients suffering from actinomycosis. A large, seemingly inoperable infiltration will often break down in part, forming an abscess, and thus become amenable to surgical interference.

RESECTION OF SHOULDER AND ELBOW ON SAME EXTREMITY.

DR. WILLY MEYER presented a woman, twenty-five years old, a Swede, who suffered from a tuberculous inflammation of the right shoulder and elbow, which had first been noticed eleven years before. While living in Stockholm the shoulder had been operated on three times; the elbow once. She came to this country in 1891, and had continuously suffered from this trouble, especially in the elbow. When Dr. Meyer first saw her, in the fall of 1897, the arm was practically useless. Repeated injections of iodoform into the elbow-joint, in combination with Bier's treatment, failed to produce sufficient improvement. On the 9th of October, 1897, the shoulder was resected; there were a number of old sinuses, especially on the outer side, which induced him to make the incision more posteriorly in a rather unusual place, and which had to be lengthened unduly in order to get the head of the bone out of the glenoid cavity. Several months later the elbow was resected. In doing this operation, Dr. Meyer said, he followed the Kocher method, with the help of a single internal incision, leaving intact all the important muscles, with their insertions, also the branches of the musculo-spiral nerve. This curved incision of Kocher gives an excellent view of the entire joint, also of the olecranon. In case the latter is diseased, it is resected by a curved incision, saving, if possible, a thin shell of

bone. The incision enables the surgeon to extirpate all the diseased bone. The operation is not a difficult one.

After the operation in this case, the speaker said, the flexors, especially the biceps, were entirely paralyzed for almost a year. The reason for this could not be made out. None of the other muscles were affected. When the patient left the hospital, in May, 1898, she was still unable to flex the arm at all; this power gradually returned, however, and now she already has comparatively good strong flexion, and is able to use the arm for ordinary housework. The functional result was very good, and would probably continue to improve. Her tuberculous disease has apparently been entirely eradicated.

DR. ROBERT ABBE said that in two cases, five years or more ago, he followed the Kocher method in resecting the elbow; the exposure of the joint was very good, but in both ankylosis followed. Since then he had not resorted to it, going back to the old method. The ankylosis in the two cases referred to was possibly due to the fact that he had attempted to get a rather too perfect hinge by leaving more of the humerus than he should have done. By leaving quite a gap between the humerus and the olecranon this would probably not occur.

CORRECTION OF DEFORMITY FOLLOWING SUPRACONDYLOID FRACTURE OF THE HUMERUS.

DR. ELLSWORTH ELIOT, JR., presented a boy who was admitted to the Gouverneur Hospital in April, 1897. He was then suffering from a marked deformity in the vicinity of the left elbow-joint, consisting in a projection backward of the point of the elbow, and a projection forward of an unusual bony prominence above the level of the elbow, the condyles apparently being in apposition with the lower fragment. The typical symptoms of a supracondyloid fracture of the humerus were elicited on examination.

It was found impossible to reduce the fracture, both with and without the aid of an anæsthetic, all the usual methods being tried without avail. Under ether, even with passive motion, it was only possible to flex the forearm on the arm to a very slight degree, and extension was also limited.

An incision was made on the posterior aspect of the arm, through the triceps muscle, exposing the line of fracture. The

lower fragment was found to be displaced posteriorly, the upper anteriorly, and because of overriding it was impossible to effect reduction through the incision made. A second incision was therefore made anteriorly, and closely underneath the skin, projecting into a cavity which contained considerable coagulated blood, was the lower end of the upper fragment, slightly expanded inferiorly, projecting through an orifice in the brachialis anticus; the fragment had thus become button-holed, and on traction it was simply held tighter. On withdrawing this fragment, the line of fracture was found to have extended transversely upward towards the condyles. The extremity of the upper fragment was trimmed by rongeur, and it was then possible to reduce the deformity by retracting the edges of the orifice in the muscle and by direct pressure on the lower end of the upper fragment. Both the anterior and posterior incisions were then sutured, with temporary drainage, and a splint applied. About a week later the patient's temperature rose to 103° F., and the wound was found to be filled with pus, apparently from the catgut sutures. The wound was thereupon opened and treated by means of continuous irrigation with very good results, as the suppuration subsided entirely within ten days.

Early in July complete union had taken place, and the boy was allowed to use his arm both actively and passively. Five months after the original injury, and three months after the removal of the splint, the functional result was the same as it is at present. Pronation and supination are practically perfect. Flexion is still slightly limited. Extension is normal. The suppurative process evidently did not interfere with the union of the bone nor affect the growth of the arm, measurements of the two arms showing no difference.

DR. R. F. WEIR said he was particularly interested in the fact that there was no arrest in the growth of the bone, although the fracture had occurred close to the epiphyseal line. The speaker said that some years ago, in attempting to correct a deformity of the thigh, he accidentally tore through the lower epiphysis of the femur, and feared that by so doing he had injured the growth of the limb. Five years later, however, he found that the limb was of the proper length. Since then he had seen a number of cases which corroborated the view that a goodly amount of damage can be done to the epiphysis without interfer-

ing with the growth of the limb, provided there is no associated suppuration.

EPITHELIOMA OF THE ALÆ NASI: RESULT OF EXTIRPATION.

DR. E. ELIOT, Jr., presented a man who first came under his observation in 1893. At that time he was suffering from an epithelioma involving the entire right ala of the nose. It was removed in June, 1893, and a report of the case was published in the *ANNALS OF SURGERY* for December, 1895.

The extirpation of the epitheliomatous mass left a quadrilateral defect where the ala of the nose had previously existed. This deformity was corrected by means of a plastic operation, the flap being taken from the adjacent tissues of the cheek.

Since the original operation no recurrence has taken place, and the cosmetic effect has been very satisfactory.

DR. WEIR said he had resorted to this expedient in three instances,—in two with a very happy result. In one case, where he tried it on both sides of the nose, he was enabled to build, in addition to the alæ nasi, a fairly satisfactory tip.

EXCISION OF GASTRIC ULCER: POSTERIOR WALL.

DR. F. TILDEN BROWN presented a man of fifty-four years, who was admitted to Trinity Hospital on December 20, 1898. His history, in brief, was that during the latter part of the preceding September he was seized with a severe pain in the epigastrium, and had vomited blood-stained food. The pain persisted with great severity, but the vomiting did not occur again, excepting to a lesser degree and without blood.

On entering the hospital there was a good deal of emaciation. The expression indicated severe suffering. There was a point of tenderness in the left epigastric region. Food, which was sparingly taken at times, gave him relief from pain, but at other times it seemed to have no effect on the gastric distress. He also complained of some pain at a corresponding point in the back. An examination of the gastric contents showed the presence of free hydrochloric acid. During the first ten days in the hospital he gained slightly in weight; then suddenly he had a number of copious stools, composed of black blood. Three days later an incision was made midway between the ensiform cartilage and the

umbilicus; through this the finger was introduced and worked beneath the omentum and transverse colon. Satisfactory retraction of the omentum was prevented by adhesions on the left side. Still, the finger was able to make out the presence of a hard mass lying in the median line and behind the stomach above. The incision was thereupon enlarged upward, and the presence of this mass made more manifest. Traction was then made on the colon, but it was impossible to draw it downward and outward, it evidently being adherent, nor could the omentum be drawn upward, on account of adhesions along its left lower border. In order to get at the mass it was necessary to tear through the gastro-colic omentum on the left side, when the greater curvature of the stomach was turned out, together with a loop of the splenic flexure of the colon. The latter was very firmly adherent to the lesion of the stomach, but was separated by careful scissors dissection. A defect in the colon, about the size of a silver quarter, was noticed; it only involved the serous and superficial muscular walls of the gut. After dusting with iodoform, a few Lembert sutures were passed through the serous coats, and the viscus dropped back. The stomach presented a three-quarter-inch ulcer about an inch from the cardia and an inch and one-half from the junction of the posterior wall with the fundus; after filling this everted part of the stomach with gauze and introducing a finger to cut upon, an incision was made with scissors half an inch or more beyond the margin of the ulcer, and the mass removed. The component layers of the wound were brought together with chromicized catgut, except the serous coat, which was inverted with two rows of fine silk. There was much induration at one extremity of the ulcer, which afforded suspicion that the ulcer was complicated with neoplasm, but the pathologist's examination disproved this. The stomach wound was covered with a strip of sterilized gauze and replaced. The patient was fed wholly by rectum for five days. No vomiting or discomfort ensued.

DR. ARTHUR L. FISK said that Dr. Flexner, of Baltimore, had published several cases of ulcer of the stomach resulting from syphilis. Dr. Fisk reported a case which had recently come under his observation. The man was a Russian, who could not speak English, therefore no history could be obtained. He entered the hospital complaining of pain in the left side, posteriorly at the base. Upon physical examination it seemed as though there were a collection of fluid, but aspiration of the chest was negative.

He was treated symptomatically, and improved so that he was dressed and about the ward for more than a week. Then he went to bed again, because of pain throughout the abdomen, for which no cause could be discovered; a few days later he called Dr. Fisk's attention to a small tumor in the left femoral region, which he said had come on during the night. It was irreducible, and inasmuch as he had a great deal of pain throughout the abdomen, it was thought best to explore this, which was done under cocaine. It was found to be a hernial sac, communicating with the abdomen, from which pus came. Ether was administered, a median incision made, and the pelvis examined. This contained pus. The appendix was found perfectly healthy, also the gall-bladder, and the anterior surface of the stomach. No tubercles could be found. The pelvis was drained, and the man made a good recovery from this operation. Examination of the pus, by Dr. E. K. Dunham, showed that it contained streptococci, but *no* tubercle bacilli.

One week after this operation the patient complained again of the pain in the left lower base, posteriorly. A needle inserted, this time, obtained pus. Ether was administered, a portion of the ninth and tenth ribs resected, the pleural cavity opened, but this was clean and healthy. The needle was then thrust through the diaphragm and pus secured. Fully a quart of pus was evacuated from this subphrenic abscess. The man died, and at the autopsy an ulcer of the posterior wall of the stomach was found; the presence of several gummata in the liver indicated that the ulcer, in this case, was probably syphilitic in origin, as in the cases reported by Dr. Flexner.

FIBROCHONDROMA OF THE SPHENOID.

DR. BROWN presented a young man, twenty-nine years old, who had very recently been operated on by him. Seven years ago he had an attack of cerebro-spinal meningitis, for which he was treated at the New York Hospital. Three months ago he had an attack of influenza, accompanied by severe frontal neuralgia. Subsequently his right eye began to protrude, and a small tumor appeared in the temporal region. The tumor grew rather rapidly; the pain increased and the exophthalmus became more marked. The patient lived out of town, and an incision was made over the mass by his physician; this yielded only blood. In Janu-

ary of the present year the man entered Trinity Hospital. When the tumor in the temporal region was exposed, it was found to be compact and firmly adherent to the temporal fossa; its removal left a rough depression on all the bones making up the temporal fossa. The eyeball was removed at the same time. The growth was at the time of operation regarded as a sarcoma, but proved to be a myxo-fibrochondroma.

Dr. Brown said an interesting feature of the case was that a tumor, apparently springing from the sphenoid bone, should have reached the outer surface at the same time by two different routes, perforating both the temporal and orbital plates, and then spreading out upon the surrounding bones. The subsequent history of this case will be followed with interest.

VENTRAL HERNIA.

DR. F. TILDEN BROWN presented a woman, twenty-eight years old, who, two and one-half years ago, was operated on in this city for what was said to be an abdominal abscess, which had been preceded for about two weeks by pain in that region. At the site of the laparotomy scar a ventral hernia developed, for the relief of which the patient was admitted to the Presbyterian Hospital on September 27, 1898. At that time the hernia was about the size of a cocoanut, with an extremely thin cutaneous covering. On October 1st the scar tissue was incised in the median line; the peritoneum was found to be adherent to the aponeurosis, and upon examination of the pelvic viscera the left tube and ovary were found to be thickened and bound down by adhesions; on the opposite side they were normal. The diseased pelvic organs were removed, and the defect in the abdominal wall—which had been separated into various layers—was repaired, the layers being separately sutured with chromicized catgut and then the entire parts reinforced with silkworm-gut sutures. After the operation the patient was kept in a very oblique position, the idea being to keep the abdominal viscera in the upper portion of the cavity. An excellent result was obtained.

DEEP EXTERNAL CESOPHAGOTOMY.

DR. ROBERT F. WEIR reported the case of a carpenter who, in July, 1898, while using his mouth as a pocket for wire nails, swallowed one of them, one and one-quarter inches long. It

stuck, he said, in his throat, and very soon afterwards he had difficulty in swallowing solid food unless finely masticated. He had also pain some two inches below and to the left of the sterno-clavicular articulation. In November no solids could be swallowed. Then examined by Dr. Weir, who found a stenosis admitting twenty-seven of the French scale at about ten and one-half inches from the teeth, but the nail was not detected. X-ray pictures were taken on four or five occasions. Two observers said they saw the nail by the fluoroscope, one behind near the fourth rib and the other in the neck, low down. Their photographs, however, failed to reveal the foreign body. Nor was Dr. Weir able, on two subsequent examinations, to recognize the nail. In November, in searching with various instruments for the nail, he employed the usual bucket corncatcher, which passed with some resistance through the stenosis, but on attempting to withdraw it it caught, and was only after some decided traction extracted. Undoubtedly some damage must have been done by these efforts, for though the patient did not raise but a trace of blood, and also stated that he felt that his nail had shifted upward, nevertheless, the contraction the more rapidly advanced, until by December 14 swallowing of even milk became impossible.

External œsophagotomy was therefore done, December 17, as low down as practicable, the œsophageal sound passing to nine and one-half inches from the teeth. From the opened œsophagus the stricture was reached one and one-half inches below the sternum, entered and explored by probes and eventually angularly bent forceps, but nothing foreign felt. The stenosis was therefore divided in two or three directions on a probe, and its further widening effected by the end of the little finger until the latter could be passed through it. Inasmuch as the œsophagus had been at this depth widely separated from its attachments, and the mediastinum correspondingly invaded, it was deemed advisable to make a provisional gastrostomy for feeding purposes. For this purpose von Hacker's method was followed, the stomach drawn out and suspended between two gilt pins, and opened after twenty-four hours. The œsophageal opening was closed by a double row of sutures, and the wound of the neck leading to it packed with iodoform gauze. Gastric feeding was practised for eight days, after which fluid food was allowed *per os*.

Now, February 23, an œsophageal bougie, size 41 French, passes readily to the stomach. This is nearly equal to fourteen millimetres, the size of the œsophagus at the cricoid level, or the narrowest part of this tube. He eats all kinds of food. The neck wound has healed, and the gastric fistula is practically closed.

LARGE CALCULUS FROM THE URETER REMOVED PER URETHRAM.

DR. WEIR presented two specimens of phosphatic calculi obtained from a woman, aged forty-five, who had symptoms of stone in the bladder for nearly nine months. The vesical calculus was readily detected and extracted by litholapaxy. In the endeavor to render certain the removal of the important last fragment, nothing was heard or felt by the final aspiration, but by a sound a piece was detected which could not be seized by the lithotrite. Then the urethra was dilated so as to admit the finger, when a stone could be felt at the moderately dilated orifice of the right ureter. This opening was through the urethra enlarged by the finger-tip and also by a long dressing forceps, and an attempt made first to press out the stone by the finger in the bladder and the thumb in the vagina; this failing, a grasp was essayed by the forceps, but the stone eluded the seizure and disappeared. It was supposed it had escaped into the bladder, but it was after some search found to have slipped up the distended ureter to a distance of three inches. At this depth—*i.e.*, equal to seven inches from the meatus urinarius—the stone was caught in a bite of over half an inch, and with much twisting and to-and-fro movements it was finally extracted. It was shaped like a small fig, its small tapering end running up the ureter. It measured one and one-quarter inches long, and was five-eighths inch at its greatest diameter, and weighed eighty grains. Like the vesical calculus, which weighed seventy grains, it was made up of the triple phosphates. The patient made a satisfactory recovery.

VOLVULUS.

DR. ELLSWORTH ELIOT, Jr., read a paper with the above title, for which see page 47.

DR. WEIR said he had seen only two cases of volvulus, both

of which proved fatal. In both the sigmoid was involved, and in both untwisting of the intestine followed by suturing it to the abdominal wall was resorted to.

DR. A. B. JOHNSON said he saw a case of volvulus about a year ago, the lesion resulting fatally. The patient was a male child, six years old, which had been ill with all the characteristic symptoms of acute intestinal obstruction for about three days. There was uniform distention of the abdominal wall, rapid pulse, pain, and vomiting. An incision in the median line revealed a volvulus of the small intestine, perhaps six feet from the lower end of the ileum, the twisted portion of the gut including more than a foot of intestine; it was in such a gangrenous condition that a resection was immediately done. The child recovered from the shock, but became delirious and died the next day. The gangrene had extended for some distance beyond the ends of the portion of the gut implicated in the volvulus.

DR. C. L. GIBSON said he had collected notes on 121 cases of volvulus which have been operated on during the past ten years. Of this number, the total mortality was 54 per cent. In cases in which reduction alone was required the mortality was 29 per cent.; when resection was necessary, 82 per cent.; in cases where, in addition to reduction, an artificial anus was resorted to, the mortality was 80 per cent. In thirty-seven cases of resection or artificial anus, only seven recoveries took place. In the cases involving the small intestine, the general mortality was 71 per cent.; in cases involving the large intestine it was 46 per cent. The speaker said that in his entire list there was only one case of successful resection of the small intestine; that case was operated the second day, 127 centimetres of intestine being removed. The average age of the patients was forty-five years, a number of them being between sixty and seventy years old.

Dr. Gibson said that in one case of volvulus coming under his observation the distention of the bowel was so enormous that he had to make an incision to let out the gas and fluid; reduction was then easily accomplished and the opening was sewn up. The man died ten days afterwards, the cause of death being septic pneumonia. Two or three days previous to his death he developed a fæcal fistula in the line of the wound.

He would recommend as a safeguard the anchoring in the wound of the portion of the gut, which had been sutured after

incision for drainage, so as to minimize the consequences, should it yield to the intestinal distention.

DR. BROWN said that two weeks ago a colored woman, sixty years old, was brought to Trinity Hospital. She had been suffering from acute obstruction for seven days. Upon her admission to the hospital there was fecal vomiting and the belly was tremendously distended. As there was some suspicion that the intestinal obstruction might be due to uterine fibroids, a right-sided lumbar colostomy was done. This opening, however, gave no vent to feces or gas, and no clue to the cause of the obstruction, and a second opening was made between the umbilicus and ensiform cartilage. Through this opening bloody serum and flakes of lymph escaped, and upon lifting up a loop of distended intestine, on the right side, the cause of the obstruction was found to be a volvulus. This was untwisted and a large gush of fecal matter appeared at the colostomy wound. Deep transverse fissures of the serous coat were noted. Following the operation the patient's temperature, which had been normal, rapidly rose to 105° F., and she died in eighteen hours. During this time two large anal dejections occurred, in addition to the feces discharged through the lumbar colostomy wound.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, April 3, 1899.

The President, J. EWING MEARS, M.D., in the Chair.

A COMPARISON OF THE MERITS OF SUPRAPUBIC AND PERINEAL CYSTOTOMY.

DR. N. P. DANDRIDGE, of Cincinnati, read a paper with the above title, for which see page 28.

DR. J. WILLIAM WHITE said that, as to the technique of the two operations which Professor Dandridge had compared, he thought all would agree with him as to the method to be adopted in perineal lithotomy. That does not require discussion. As to the technique of suprapubic lithotomy, he could only say, after an experience of a number of years, that he had never found it necessary to resort to the transverse incision, the Trendelenburg posture, and a sufficient median incision having given him all the room he wanted for intravesical manipulations. So, too, he was content with distention of the bladder with an antiseptic fluid. He had never had occasion to change that to dilatation by air; and he still preferred to use the rectal bag, not so much for the purpose of bringing the bladder higher in the pelvis or making it an abdominal organ, as for giving it support during the manipulations necessary after it was opened. He did not regard it, as he once did, as essential to the operation, believing, as Dr. Dandridge had said, that it may be dispensed with if the patient is in the Trendelenburg posture. As to the fatality, which Dr. Dandridge, in a general way, said was greater after the suprapubic section, he saw no *a priori* reasons, given a certain class of cases and comparing the mortality results after suprapubic and perineal operations, why the division of the tissues and opening the bladder above the pubes should be attended with any greater fatality

than the division of the tissues and opening of the bladder below the pubes; it seemed to him that the statement required very careful consideration in regard to each particular class of cases, and should not be accepted as a general surgical rule in selecting these operations.

Taking up the particular points in the order which Dr. Dandridge had mentioned them, drainage of the bladder, if it is for obstruction, is usually for either urethral or prostatic obstruction. If urethral, he thought there was but little difference of opinion as to the propriety of adopting the perineal route for its relief. If the bladder is to be drained for conditions brought about by urethral obstruction, the perineal route offers an opportunity for the relief of the obstruction itself; if the obstruction is prostatic in origin, the perineal route has the advantage of producing an occasional cure. The method of Harrison, to which Dr. Dandridge had alluded, has been followed, in the cases reported by Harrison, by a cure more or less permanent. He thought, however, in cases with a deep posterior prostatic pouch, it was not so easy to plan the perineal operation with safety so that it should reach and drain the bottom of such a pouch, and he had found that suprapubic drainage, by one or other of the siphon methods, had, on the whole, given somewhat better results. He should be disposed, in operating entirely for drainage and where there was evidence of an existing deep prostatic pouch, to choose the suprapubic incision, followed by some method of siphon drainage. If one was certain of reaching such a pouch by the perineal route, it would probably be the method of choice; but one cannot be certain.

For cystitis, pure and simple, the perineal is undoubtedly the method of choice, but he did not think that the subject should be passed by without an allusion to the great neglect by the profession of the use of the permanent catheter. The general practitioner is too apt, in cases of cystitis, without a fair trial of continuous catheterization, to ask a surgeon to perform an operation for drainage, where the intelligent use of the permanent catheter (which can always be kept up for from three to five weeks, and frequently for a much longer time) would very often produce such changes that no operation would be necessary. He made that remark on the basis of the cases that he saw in consultation, where he had found that the use of the permanent catheter is

hardly considered, as a rule, by the medical attendants. If the rules laid down by Guyon and his school for the insertion and care of the catheter, its fixation in the proper position, bringing it not too far within the bladder, and for irrigation of the bladder through the catheter and of the urethra alongside of the catheter, are carried out, it will often enable one to dispense with every other method of drainage.

In operations for drainage in cystitis of the tubercular bladder, the suprapubic is almost always the method of choice. The lesions of tuberculosis of the bladder are apt to be about the vesical neck and base of the bladder (except when they involve the urethral orifices), and infection of the perineal wound is then certain to follow perineal drainage. The suprapubic method is also desirable because it offers an opportunity to treat the lesions directly, and is the method to be preferred, in his opinion.

When bleeding is the indication for drainage, the suprapubic method should be selected. The largest perineal tube is apt to be unsatisfactory in the presence of serious bleeding, the clots from which are much more easily disintegrated and removed through a suprapubic than through a perineal wound.

Permanent drainage of the bladder was, in his experience, unsatisfactory, whether suprapubic or perineal. So far as experience goes, he did not believe that he had any basis for choice. He had not liked the results whether the opening had been above or below the pubes. He thought it to be largely a matter of individual experience, and that there is no broad ground for choosing which route to select.

In regard to stone, which was the second subject taken up by Professor Dandridge, of course all agree that cystotomy of any kind should be done only in exceptional cases. Litholapaxy is the choice with surgeons the world over. As to the exceptional cases that were mentioned by Dr. Dandridge, he thought there was little or no ground for disagreement. Stone and big prostate conjoined (putting aside the operation of castration, which some surgeons would consider and others would not as likely to procure more favorable conditions by causing shrinkage of the prostate), if requiring cystotomy, would seem to be better dealt with by the suprapubic route, enabling one to remove the stone and to satisfy one's self as to the condition of the prostate, and perhaps to supplement the cystotomy by a prostatectomy. If he had to give a rule, that would be the one he would lay down.

In encysted stone, unless it projects into the bladder and can be lifted out of its pouch with a scoop, the obvious advantages of the suprapubic method make it the operation of choice. In very large and hard stones, those that are not suitable for litholapaxy, the suprapubic has advantages over the perineal method, but he thought it to be open for consideration whether a combination of two methods—perineal lithotrity—will not supplement the suprapubic in these cases. Keith's results, and those of other English surgeons practising in India, have been so successful that most genito-urinary surgeons have their attention turned in that direction, and would, at least, consider the fragmentation of very large stones in the bladder through a perineal opening before deciding finally on a suprapubic operation.

There are certain deformities, like ankylosis of the hip, which would seem to pretty well settle for the surgeon the operation to be selected. A bad case of ankylosis makes a perineal operation a difficult one, and if it were not a suitable case for litholapaxy, it would be thrown into the class of suprapubic operations.

In cases of foreign bodies existing as nuclei of stones, not known in advance, but only discovered after litholapaxy has begun, the perineal operation has usually been a most satisfactory one, in his experience, and one which he thought should be recommended.

In stricture of the urethra, if it is possible for a guide of any size to be inserted into the bladder, the perineal operation gives opportunity for relief of the stricture. In case of false passages with stone, it would seem that the perineal operation again would be selected for the same reasons, and the case of a stone impacted in the vesical neck so that it could not be pushed back into the bladder and made the subject of litholapaxy, a median perineal operation would seem the most direct method.

As to the mortality, in anticipation of this discussion, he had looked up the latest figures he could find from a number of the journals of the last year or two, and from some of the more recent text-books, and added them together, making a number running up into the thousands. He found that the perineal operation in children had a mortality of 3 per cent., and the suprapubic 12 per cent. So there can be no question which operation should be performed in children. In adults the perineal operation has a mortality of from 8 per cent. to 12 per cent., and the suprapubic 12 per cent., which would throw a choice somewhat in favor of

the perineal method, although not so strongly as in children. In old men the perineal operation has a mortality of from 38 per cent. to 40 per cent., while the suprapubic has only 25 per cent. to 30 per cent. So that in old men the perineal operation seems suddenly to be the more dangerous of the two, if these figures can be relied upon. He wished to say once more, because he had omitted much mention of litholapaxy, that he was only speaking of cases in which a cutting operation was required for some reason, that, in his opinion, litholapaxy is the operation of choice in all cases wherever it can be performed.

As to prostatic cases for simple drainage after catheterism has failed, and when no radical operation is thought of, the perineal operation is to be preferred, on account of the chance of cure, which has already been alluded to, and on account of its simplicity of performance; but if any radical operation is contemplated, the removal of any portion of the prostate, there is no question as to the relative advantages of the two operations. Even if prostatectomy is to be done through the perineum, the advantages of preceding it by a suprapubic incision, enabling the prostate to be pushed well down into the perineum, are so great that he thought suprapubic cystotomy should be made, in the vast majority of cases, an essential part of the operative procedure.

As to tumors, except for the distinctly pedunculated tumors, shown to be such by the cystoscope, the suprapubic operation seems to have obvious advantages. Tumors of various sizes and shapes can be recognized and removed. Bleeding, to which Dr. Dandridge had alluded, may be generally controlled with the patient in the Trendelenburg posture, and by careful packing, so that a sessile tumor may be entirely isolated with a little patience and the operator enabled to see what he is doing; then the peritoneum may be opened and a portion of the wall of the bladder inverted and then sutured externally, the peritoneum closed, and the portion of bladder wall containing the tumor incised; all sorts of manipulations may be employed which are quite impossible through the deep perineal wound, working by the touch and in the dark. Except for pedunculated tumors, the suprapubic operation should therefore be selected, and yet his most satisfactory cases of bladder tumors had been perineal operations, and in his own experience the mortality had been less, and he had had the

best results in those cases in which he had been enabled to remove the tumor through the perineal incision. The theoretical arguments are against the selection of that route, but he did not feel that he should be quite honest if he did not say that his own experience seemed to run counter to the rules dictated by theory.

As to the relative dangers of the two operations: In the suprapubic operation, so far as danger to life is concerned, the chief cause would be infiltration in the prevesical cellular tissue. This can nowadays be avoided; it is not often seen, and if there is great risk of it, as when there is a very septic cystitis, Senn's operation of suprapubic cystotomy in two stages may be adopted with increased safety. The reopening of the wound he had not seen after suprapubic cystotomy. He had seen the perineal wound open, so that he could not think that to be a strong argument against suprapubic operations. The tendency of hernia was not very marked in the ordinary cases of suprapubic cystotomy. On the other hand, perineal cystotomies, if lateral, seem to have definite disadvantages. Impotence has followed, and in a case reported by Dr. Cabot there was a reversed seminal current, the semen, upon ejaculation, passing into the bladder rather than by the normal route; stricture has followed. Occasionally one has quite as great a degree of incontinence of urine as that which follows the suprapubic operation, and a fistula in the perineum is not much to be preferred to a fistula above the pubes. The argument as to the direction which "nature" intended the urine to take, whether below or above the pubes, has not much weight in his mind.

DR. EDWARD L. KEYES said that he would allow himself to touch upon two points that had been brought up,—namely, statistics in India and the far East, and the recently revived Bottini operation. Of the first he believed that results in India and the East, and in Egypt (where they seem equally good), should not necessarily influence us greatly in deciding what we shall do here. These Eastern people do not seem to die when they are operated upon. Whether they are spared because they do not use alcohol or for some other reason he did not know; but he did know that statistics in those countries are exceptionally good in the hands, seemingly, of all operators. A gentleman who spoke from personal knowledge told him once that there was a certain missionary in (he thought it was) Arabia whom he had known for many

years to dispense his services among the natives to their bodies as well as to their souls. He was exceedingly successful in cutting for stone. Finally he died, and his widow, looking about for means of support and finding none, concluded that she would continue his business as a lithotomist, although her only knowledge of the operation consisted in what she had seen her husband do. She therefore got the instruments together and went ahead, cutting for stone. She had plenty of patients and a success equal to that which her husband had obtained.

Now about the electrocautery as applied to the prostatic bar; the worst thing that can be said about it is that Bottini devised and practised and wrote about the method for very many years, and never gained any general following until quite recently in Germany and in New York, in both of which places a special advocate has sprung up, due, he believed, to the fact that the pendulum of general prostatectomy had swung too far, and that efforts to find simpler means of relief were being attempted in all directions.

The matter is not yet judged, and we are not justified in drawing conclusions about it until it has been more widely tested. All that we know is that multiple operations are required, and that the mortality is high,—although, of course, some of the deaths are explained away. Moreover, the operation does not belong cleanly to general surgery, but requires special training and technical skill. More operations must be done before we can generalize about it. He considered it still in the balance. It cannot be discussed until many more individuals have performed it, giving points of view from different directions.

Dr. White had mentioned the permanent catheter tied in. This method of drainage is worthy of more consideration. He had a patient long ago who wore a Holt's catheter tied in for about four years, night and day. He kept a cork in it, which he withdrew at stated intervals, and walked about at his business with great comfort, until multiple stone formed from lack of efficient washing. He cut him and removed the stones and a portion of his prostate, enabling him to dispense with his catheter and urinate at will.

He had employed this method of drainage in many cases, and considered it a means not to be lost sight of.

The methods of permanent drainage, both suprapubic and

perineal, he had been in constant contact with for more than thirty years, since his student life. One of his earliest memories is that of an old gentleman who,—he thought it was in the year 1867,—having a prostatic obstruction through which his honored master, Dr. Van Buren, could not pass a catheter, was cut over the pubes for drainage, and wore for nearly a year, until he died, a long double silver tube, made exactly after the plan of the ordinary tracheotomy-tube, and it served its purpose admirably.

One of his own very early operations for permanent drainage was for a case of cancer involving the prostate and floor of the bladder. This patient did very well for a considerable period, wearing a long, silver, flattened perineal tube tied in, but he did not get about very much. And from these cases onward he had seen a variety of hard and soft rubber devices applied for the purpose of continued drainage and worn sometimes through the perineum, sometimes above the bone, with more or less comfort and discomfort, according to the case; but worn, and worn for a long time with safety.

Drainage, of course, is done for the purpose of relieving the necessity of the bladder for a considerable time or permanently, when the natural right of way cannot be re-established, and for the cure of chronic (often putrid) cystitis.

For the latter his preference was always the perineal route; for the former, notably in cases of cancer and tubercle, the suprapubic. Prostatic cases require individual study in electing a route, but, he thought, most of them, when such an unusual means was called for, would in election fall under the suprapubic route, unless the drainage be used as a method for the cure of putrid cystitis; and then he agreed with Dr. Dandridge that the perineum was usually the better direction in which to drain.

As for the actual danger to life, as a consideration, his belief is that the perineal route possesses the less danger. As for ease of execution, both are so simple that there is little choice.

He differed from Dr. White as to the usual cause of death after suprapubic cystotomy. He did not fear hæmorrhage, or sepsis, or infiltration, or suppuration in the prevesical spaces. All of these things may occur, but they can be headed off. The danger after suprapubic cystotomy, and the only dread he had, was urinary suppression. He considered it the most constant cause of death. Of course, patients do die also even with polyuria, with

high temperature, uræmic; and they die in other ways; but he looked upon suppression as the most deadly complication.

And, furthermore, he considered a patient with urinary cachexia, septic, with pyelitis, putrid urine, chronic cystitis, feeble digestion, and apparently no nerve-force left, a better subject for operation, either suprapubic or perineal, than he did the other type of patient, nervous, neuralgic, with hard arteries, abundant, pale, thin urine, of low specific gravity, containing little or no pus, especially if he have also nocturnal polyuria. This latter patient is very likely, after operation, either to go on with increased polyuria and perhaps wandering in his mind, to die uræmic, with a high temperature, or to suffer prompt suppression which does not yield to treatment.

He wished to make another statement also in favor of the use of laughing gas, or of chloroform instead of ether for any operation upon the bladder of an old man, especially if that operation is to be a long one. With laughing gas one may operate for an hour or more, and the patient comes out smiling, without nausea, shock, or depression. Suppression is often due to the effort made by a damaged kidney to eliminate a large quantity of ether from the blood, and the septic pneumonia coming on in the second week after operation is often started by the traumatic irritation of the lungs caused by breathing the dense fumes of ether for a long time.

In many cases of inoperable cancer, involving the prostate and floor of the bladder, he had seen patients made quite comfortable for many months by a suitable permanent suprapubic tube; but he wished to say here that cutting the bladder open and thus relieving tension does not always, as Guyon asserts, relieve tenesmus. He had seen the latter occasionally persist, notably in tubercular cystitis, even when the bladder was kept empty by a permanent suprapubic tube. He remembered one rather curious case, of an old man with cancer, who wore a permanent suprapubic tube for the better part of a year before his death. He enjoyed great comfort, and never had the feeling of vesical repletion or of a desire to urinate excepting when he went to stool; but when he, by voluntary effort, extruded the contents of the rectum at stool, he felt a painful desire to urinate, with a little tenesmus, although the bladder was empty, the tube being in place.

Now as to stone. Any one who is reasonably versed in litholapaxy by having operated a number of times must be convinced of its general applicability for children, adults, and old people, in a great majority of instances. But he believed that it was generally conceded that when, for any reason, a stone should not be crushed, the suprapubic operation was called for, and notably under these four circumstances:

- (1) When the stone is excessively large.
- (2) When it is encysted.
- (3) When it is complicated by tumor.
- (4) When it has formed upon a foreign body.

Of course, when the contraindication to litholapaxy is urethral obstruction, then the perineal route is called for, because that operation deals not only with the stone but often with its cause (stricture). He wished, however, to make the point that there are a certain number of quite small stones in prostatic subjects which in very skilful hands might be mastered by litholapaxy, but which, none the less, will do better if treated by cystotomy suprapubically. He referred to cases of small, flat stone, difficult to pick up from the post-prostatic pouch, notably in cases where the prostate is long and has an irritable granular bar. In such cases the irritation of this bar, produced by the manipulation with large instruments, often causes so much cystitis that, although the stone be wholly removed, the patient is worse off after the operation than before, and the effort at his relief may give him a cystitis of longer duration and of greater discomfort than would have been given by a well-performed prostatectomy. In these cases he had been often willing to make the patient's necessity the surgeon's opportunity, and to cut where he might equally well have crushed, believing it to be to the patient's advantage to do so.

For prostatic hypertrophy prostatectomy, it seemed to him, especially total prostatectomy, had been overdone. In this country he believed, and he was sure in France, there is to-day a tendency to do less of it, and to return oftener to the more conservative use of the catheter, with vesical lavage. But still prostatectomies have to be done, and the question is the election of a method. Upon this point it is very difficult to generalize.

His experience in the matter led him to believe that partial prostatectomy, if the urethral outlet be lowered at the same time,

will give as good a result in many instances as total prostatectomy, and with less risk to life. Very soft prostates lend themselves readily to enucleation and may be properly shelled out whole. Interstitial fibromyomata, of course, should be taken out; but in many, very many, cases of prostatic overgrowth, particularly the very hard variety, if the fringes and pedunculated outgrowths, and horse-collar projections, and third lobes, and, notably, the bar, be thoroughly removed and the internal urethral orifice cut away with an *emporté pièce* well into the prostatic sinus; if all this be done, the functional condition of the patient is rendered as good as after total prostatectomy; the operation is shorter, hæmorrhage less, danger to life less, and all these things can sometimes be done safely and effectively through the perineal route, when the prostate is not peripherally very large, so that the finger, passed through the wound, can easily pass beyond the vesical orifice and explore thoroughly. In such cases, then, he preferred the perineal route for the performance of partial prostatectomy. The results are excellent, and danger to life relatively small. When, however, the prostate is very large, it cannot be properly attacked through the perineum, and the suprapubic route must be elected, even if the prostatectomy is to be partial.

Finally, as to a choice of route in the case of tumor or cancer there can be no question. The high route, allowing the faithful eye to aid the possibly faulty finger, must be elected.

DR. ARTHUR T. CABOT confined himself to a simple statement of his personal experience in the methods of cystotomy.

In regard to the choice of incision for bladder drainage, he did not recall any cases in which he had made incision into the bladder in the past ten years for bladder drainage alone. He had operated a number of times where drainage had been a very essential part of the operation, but in which the operation had also the very important function of correcting some condition which was responsible for the persistence of the cystitis, such as obstruction in the prostate, in the urethra, or some tumor or calculus in the bladder. He thought the reason that he had not opened the bladder for drainage had been that he had had such good success in the method of drainage through an inlying catheter. He had used this form of drainage a great many times, even on patients who were desperately sick, too sick, it seemed, to bear a cutting operation, but who had improved immediately

when adequate drainage through a catheter was supplied. Some of these patients, in whom the urine had been almost suppressed, and who already showed evidences of incipient uræmia, had quickly recovered after the catheter was placed in position. He had even used catheter drainage in cases of quite profuse hæmorrhage into the bladder. In such cases it is possible, by patience, to suck the blood out by attaching a stiff rubber tube to the end of the catheter and, as it were, milking it,—that is, stripping it and allowing it to expand, and thus drawing the clots forward out of the bladder. In a number of cases in which he had used this method the hæmorrhage had ceased when the bladder was emptied. In the few cases in which the hæmorrhage had persisted he had opened the bladder, and always by the suprapubic route, which he selected, feeling that it was important to discover and remove the cause of the hæmorrhage, and to afford opportunity, when it was troublesome, to pack the bladder with gauze.

In regard to the operation for stone, he believed, as had been already said, that litholapaxy was the operation of choice. He had never yet met a stone so hard that it could not be crushed, and yet small enough to be properly approached by the perineal route, so that in cases in which he had failed in crushing he had always used the suprapubic incision.

As to the statistics of crushing, he did not think the results reported from India need any special explanation, for a recent examination of his own results showed that in 116 cases there were four deaths, and of these, two patients died of pneumonia, consequent upon a chronic bronchitis, which existed before the operation. The average age of the patients was a little above sixty years. He could make no comparison of the two operations under his own hand, for he had used suprapubic lithotomy only in difficult cases, where he could not crush. In children he thought that lateral lithotomy was very much safer than the suprapubic operation. No doubt most children can be treated by litholapaxy, especially if, in the cases where the anterior urethra is narrow, one opens the perineum and makes the operation a perineal lithotomy. It is quite extraordinary how greatly the perineal incision adds to the ease of the operation. The deep urethra is so distensible that it easily admits instruments that were much impeded, both in their introduction and their after manipulation, through the penile urethra.

He thought there was comparative unanimity of opinion that the high operation was the proper one for dealing with bladder tumors. Dr. White had said that he had had better results in the few cases that he had done by the perineal route. Possibly that was because they were instances of simple pedunculated growths. Even in these cases, the suprapubic opening affords better opportunity for thorough removal.

In the operative treatment of prostatic hypertrophy he had had but little experience in the use of the perineal incision. He had operated by the perineal route and followed the method proposed by Dr. Harrison, in some of his early cases, with fairly good success. He had only employed the suprapubic route of late years, because it gives a better opportunity for appreciating and correcting the conditions causing the obstruction. The perineal incision has, however, one advantage, especially when the obstruction is a bar across the neck of the bladder; and this is that the tube introduced through the prostatic urethra for drainage keeps the wounded surfaces apart during healing, and thus moulds and tends to keep open the newly formed outlet of the bladder. It would seem well to introduce perineal drainage after a suprapubic prostatectomy when the conditions seem to make this moulding of the urethral orifice important. For simple purpose of drainage after prostatectomy he had not for many years used a perineal tube, for he had always found suprapubic drainage with two tubes thoroughly satisfactory.

As to one or two other incidental points, aside from the direct line of discussion, of interest. Dr. White had pointed out the real use of the colpeurynter; that it raises the base of the bladder and brings it near the suprapubic opening, and for that purpose Dr. Cabot had used it. He operated in the Trendelenburg position, and as the object of that position is to induce the bladder, by its weight, to fall towards the umbilicus and so to increase the distance between the fold of peritoneum and the pubes, it seems more reasonable to fill it with a heavy fluid, which will add to its weight, rather than with air.

DR. L. S. PILCHER said that it might not be amiss to remember that the suprapubic route for reaching the bladder had been appreciated as generally practicable only during the past few years, although the history of surgery shows that the sixteenth century should be credited with its introduction. It is true that

since that time it has been suggested from time to time, but only to be laid aside, so that all certainly know, when it is said that fifteen years ago it was unused and had no standing as a surgical procedure, that the statement is correct. That being the case, the mental preoccupation of those surgeons whose experience dates back beyond that period has been with methods other than the suprapubic. It is only since the suprapubic operation has been demonstrated to be a practical thing that bladder surgery has made any very great advancement over that which it had attained in the practice of our fathers. In these more modern indications for attack on the bladder, it has been stated by those who have already spoken that the suprapubic route, as a rule, is the one to be adopted, but in the one class of bladder operations in which our fathers excelled us,—viz., that for the removal of stone,—one still finds a frequently expressed opinion that procedures which can be used through the urethra and perineum are still the procedures of choice. The previous speakers had each repeated that the method of choice for attacking stone in the bladder is that of litholapaxy. But since, in the work of the speaker during the past twelve years, litholapaxy has not been the method of almost universal choice, he ventured to strike a discordant note by trying to give some reason why it had seemed to him in his own work to be a more proper thing, as a rule, to reach a stone in the bladder by a cutting operation through an incision above the pubis than to trust to the attempt to remove the stone by crushing and suction and washing.

He had no statistics to present. He doubted very much whether these matters were to be settled by statistics. Any surgical method of procedure can be tested by general principles rather than by statistics.

He asked first, whether the reaching of a stone in the bladder and its crushing by an instrument and its after-evacuation by a process of suction and washing is a more simple operation than the operation of making a simple incision into the bladder and its removal by a forceps. Does it make any less traumatism? Does it take any less time? Does it involve any less shock? Is it a less serious operation as a whole?

It had seemed to him that, as a rule, the suprapubic incision could be done, and is being done to-day, in a manner that constitutes it a more rapid, a more simple, a less severe operation, and

one which is attended with greater likelihood of permanent cure than the procedure which is understood by the term of *litholapaxy*. He spoke from the stand-point of a general surgeon, not from that of one who has devoted himself to dealing with this class of cases specially, who, by reason of his special aptitude or special experience has been able to obtain a special skill in the performance of a peculiar technical procedure, but rather from the stand-point of the general surgeon who occasionally has to do with this condition,—what should be the operation of choice for this numerous class of surgeons, that they should seek to empty a bladder of stone by litholapaxy or by the perfected suprapubic incision.

He was inclined to believe, from the observation of the results of the work of others and from the limited experience which he had had himself, that in the hands of the average surgeon the operation of litholapaxy is by no means a generally safe and desirable operation; that it is in many cases an incomplete operation; that it is in many cases a severe and fatal operation; that it is a more difficult operation to perform than is the operation which may be done of opening the bladder above the pubes or even through the perineum. For these reasons he found that for the last ten years the apparatus for crushing the stone in the bladder in his own work has been more and more left upon the shelf, and that more and more the attempt to remove the stone as a matter of routine by the incision had been adopted. Any bladder into which a catheter can be introduced, however small, —and the softer and less irritating it is the better,—and which can be at all dilated, when it is possible to have access to the inflating bulbs of the ordinary syringe, and still better, if one has an inflating bulb of a cautery apparatus, any such bladder may be readily and in a moment inflated and made to protrude above the pubes so as to be readily accessible; no special apparatus is needed; the knife, forceps, and the simplest retractors are all that are required. When the bladder is opened, the possibility of its full exploration is secured, the emptying of the bladder is a matter of but a short time, while the least possible traumatism is inflicted upon it. When one compares the relative amount of traumatism of the suprapubic with that of the perineal operation, it seemed to him that even in the simplest perineal operation (and in the hands of a skilled operator it is ordinarily a simple operation) the

amount of traumatism is less in the suprapubic operation, and certainly the interference between the vascular and nervous relations is much less in the suprapubic than in the perineal; the reflex, distant, late contingencies are likely to be much less in the suprapubic than in the perineal operation, wherefore it was that in his own work he had adopted the suprapubic operation as the method of choice even in dealing with ordinary cases of stone in the bladder.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. The Relative Value of Sterile and Antiseptic Ligatures. By DOCENT DR. C. HAEGLER (Basel). Primary union is the rule under aseptic precautions, and yet weeks or months after operation ligatures may cause trouble and be thrown off. This is specially true after operations for goitre and for hernia. The complication is more annoying than dangerous. The author has found that the slight sero-purulent fluid around the ligature is generally sterile, but that sections of the knots in the ligatures (silk) show innumerable germs between the individual fibres of the silk. This has been found so often that accident is excluded.

In the Basel clinic silk sterilized in steam or by boiling in water has been used for years as ligatures. Bacteriological examination of the material, as it is taken from the spool, has always given negative results. If this sterile material is pulled through the firmly closed fingers during the operation (not immediately after the hands have been disinfected) and again examined, it is never found to be sterile, unless the hand has just been dipped in sublimate solution. Numerous experiments with numerous operators have shown the above to be true, and have also demonstrated that sublimate silk remains sterile under the same circumstances. In fact, the sublimate silk may be drawn through unwashed or even much infected fingers and yet fail to give positive results in culture media.

Since sublimate silk has been adopted for ligatures in the Basel clinic (four months) there have been no cases of suppuration from ligature. The silk (from which all grease is removed) may be prepared either by soaking for several days in a strong

solution of sublimate or by boiling it in the solution for a few minutes. Mercury has such an affinity for silk that washing in water or in alcohol fails to remove it from the silk thus prepared.—*Centralblatt für Chirurgie*, No. 5, 1899.

JOHN F. BINNIE (Kansas City).

HEAD AND NECK.

I. Tumors of the Cranial Vault. By DR. LEOPOLD REINPRECHT. (Innsbruck). The detailed clinical course of a single case constitutes the substance of this article. The history is that of a perfectly healthy woman who knocked her head against a door; shortly after a small tumor appeared that attained the size of a goose-egg within eight months, and whose physical characteristics were as follows: Situated in the mid-frontal region, just above the root of the nose, it was of elastic consistency, in some parts permitting the perception of septa of bone. Large veins coursed over it in the skin, which was freely movable over it; no pulsation, no tenderness, not compressible, and no glandular metastasis could be made out. Diagnosis: Sarcoma of frontal bone.

During the ten days of observation at the clinic the tumor grew so rapidly as to oblige operative interference.

The operation consisted in the removal of the tumor down to the dura mater with the trephine and wire saw, but it had to be done in two sittings, owing to the profuse bleeding, which was controlled by pressure and provisional sutures. At the second operation some of the small particles of tumor attached to the dura mater were removed with the spoon. But in spite of this a recurrence took place one year later.

Macroscopically, the tumor consisted of radiating spicules of bone with masses of soft and vascular tissue intervening. Microscopically, there could be seen an alveolar arrangement due to the interlacing of the blood-vessels, round about which there was a collection of polygonal and pouching connective-tissue cells.

The diagnosis is that of angeio-sarcoma. The author could find but one other similar case, reported by Wasserman.

In a collection of forty-eight cases of cranial tumors, gathered by Frölking, but twenty were operated radically, nineteen not operated, and in the remaining nine cases operation was abandoned, on account of profuse hæmorrhage. Two additional cases are cited, one in which Kocher ligated the common carotid, and another, in which Bardeleben ligated the common carotid and subsequently the temporal and posterior auricular arteries. Other surgeons, who operated less radically, obviated hæmorrhage by applying caustic paste to the partially removed tumor. (From which we gather the more strictly surgical procedure to be either operation *en deux temps* or preliminary ligation of the common carotid.)—*Beiträge zur klinischen Chirurgie*, Band xxiii, Heft 2, p. 434.

MARTIN W. WARE (New York).

II. Cleft Palate Operations on Infants. By DR. J. WOLFF. Wolff has performed the operation of staphylorrhaphy on sixty-six children under one year of age. Of these forty-five were cured. In fourteen the result was imperfect or the sutures gave way entirely. In seven the result was fatal.

The author repairs the harelip a few days after birth. The cleft in the palate is closed in three sittings, with intervals of from seven to eight days between. At the first sitting the right mucoperiosteal flap is loosened, at the second the left, and at the third the sutures are applied and approximation attained. The author claims excellent results both as regards deglutition and phonation.—*Centralblatt für Chirurgie*, No. 4, 1899.

JOHN F. BINNIE (Kansas City).

III. Cervical Sympathectomy in the Treatment of Epilepsy, Graves's Disease, and Glaucoma. By PROFESSOR THOMAS JONNESCO (Bucharest). In January, 1897, Jonnesco published a short article, entitled "Total Bilateral Resection of

the Cervical Sympathetic in the Treatment of Graves's Disease and Epilepsy" (*Centralblatt*, 1897, ii, 32-37). Since that time Jonnesco has had occasion to perform this operation in fifty-four cases. In September, 1897, the author resected the upper ganglion of the cervical sympathetic in a case of glaucoma. He subsequently performed this operation seven times. Since August, 1896, Jonnesco has performed sympathectomy in sixty-three cases, forty-three of these suffered from epilepsy, one from epilepsy and chorea, one from epilepsy and Graves's disease, eight from Graves's disease (in five cases primary, in three secondary), one from Graves's disease and glaucoma, seven from glaucoma. Of these sixty-one cases, in forty-two the three cervical ganglia with the portions of the sympathetic connecting them were resected on both sides; in one case total resection on one side with removal of the upper two ganglia of the opposite side; in eight cases complete unilateral resection; in three partial bilateral resection, the entire cervical chain with the exception of the lower ganglion being removed. Of seven cases of glaucoma bilateral resection of the upper cervical ganglion was done in six cases, and unilateral resection in one case.

There was no mortality attached to the operation. Six patients died either shortly after operation during epileptic attacks or later from intercurrent disease. (Here follows a list of the communications Jonnesco has made upon this subject. Also a list of the communications of other authors. For these the reader is referred to the original article.)

Jonnesco discusses the amount of sympathetic which must be resected. Mere section is not sufficient. The extent of resection depends upon the disease present. In Graves's disease it is necessary to resect the entire cervical sympathetic on both sides in order to destroy the communications to the eye, thyroid, and heart. The operation, while a delicate one, is not difficult. The author performs it in two stages, allowing seven days to elapse before operating upon the remaining side.

The *rationale* of this procedure, as applied to epilepsy (according to Jonnesco), is that the resection alters the cerebral circulation, congestion taking the place of anæmia, this congestion increasing the nutrition of the nerve-cells and freeing them from toxic products. In cases due to visceral irritation the path is destroyed by which these irritations travel from the viscera to the cerebrum. Mere section of the nerve will not accomplish this. There must be resection of the entire cervical sympathetic. (The author discusses the priority of the operation, and claims that he and not von Baračz is entitled to priority. From Jonnesco's account it appears that von Baračz did a partial resection of one sympathetic incidentally in the course of ligating the vertebral artery.) (*Centralblatt für Chirurgie*, 1896, xxiv.)

In glaucoma, resection of the upper cervical ganglion is advocated. This results in dilatation of the arteries, lowering of the blood-pressure, and the diminution of the existing extravasation. It destroys the excito-secretory fibres, thus lessening the aqueous humor; it destroys the iris fibres, producing contraction of the pupil; the iris angle and the secretory canals are relieved and the aqueous humor afforded a ready exit; finally, the destruction of the fibres supplying the smooth peribulbary muscular apparatus causes relaxation of these muscles, removes the pressure from the emissary veins, and thus restores the venous circulation.

There are some transitory and some permanent symptoms which follow sympathectomy. Among the transitory symptoms are noted congestion and warmth on the side of operation, increased secretion of tears, nasal mucus, sweat, and saliva; in addition, slight conjunctival congestion. The permanent symptoms, which are constant regardless of the disease present, are stenosis and paralysis of the pupil, ptosis of the upper eyelid, retraction of the eyeball. These are due to paralysis of the dilator pupillæ, of the smooth muscular fibres of the upper lid, and of the smooth muscular fibres contained in the capsule of Tenon. Remote evil results were not noted in any case. There were no trophic disturbances.

The final results were as follows: In ten cases of Basedow's disease, six are classed as recovered and four as improved. The recoveries lasted twenty-six, twenty-five, fifteen, fifteen and one-half, seven and one-half, and four months respectively. In all these cases genuine Graves's disease was present; in one there was, in addition, a double glaucoma. There was immediate disappearance of the exophthalmos, a sense of well-being and disappearance of the nervous symptoms referable to the heart. Following this the trembling, tachycardia, carotid pulsation, and pulsation of the goitre, when present, diminished. The pulsations diminished from 140 to 70 or 80, and though there was in some cases an occasional increase in the number of pulsations, yet the number finally returned to normal. The goitre slowly decreased in size. There was temporary expansion and pulsation, then the gland became smaller, and after months or a year reached the normal size. The change in the gland is sclerosis. Extensive resection of the upper two ganglia was done in four cases, complete resection in two.

In a case of Graves's disease, in which unilateral resection was done, there is, four months after operation, a marked improvement on the operated side, but no improvement on the opposite side.

In three cases in which great improvement was obtained Basedow's disease was secondary, the goitre appearing much earlier than the other symptoms. In these cases the goitre was not affected, but the other symptoms were improved for periods of five and one-half, five, and four months.

The author concludes that the operation meets with its best results in primary Graves's disease (that is, in those cases in which excision of the goitre is fatal or without benefit). It offers less favorable results in secondary Graves's disease, but in these cases, added excision of the goitre would result in complete recovery. It is these latter cases that Josef Sörgo's statistics show are favorable for excision of the goitre.

Some cases in which the result at first appears doubtful will be found to improve after several months have elapsed.

Forty-five patients were operated upon for epilepsy. Of these nineteen have been watched long enough to judge of the result of operative interference. Five of these have been without an attack for two years, one for nineteen months, three for from fifteen to eighteen months, and one for six months. Six cases were much improved. Two were unimproved.

One of the epileptic cases which recovered was also cured of chorea.

Eight cases of glaucoma were operated upon, in one of which Graves's disease was also present. In the latter case total resection was done. In the other cases excision of the upper ganglion; in four cases, bilateral; in three, unilateral. In those cases in which atrophy of the pupil was not complete the result was excellent.—*Centralblatt für Chirurgie*, 1899, vi, 161-170.

RUSSELL S. FOWLER (New York).

ABDOMEN.

I. The Value of the Different Methods of Bowel Union.

By DR. V. CHLUMSKY. The author, in an original communication, states the results of his experiments in this subject. The question as to the use of buttons or sutures in intestinal anastomosis becomes more vital each year. On reviewing the literature of the last few years it is seen that the number of surgeons advocating the use of the button, and particularly Murphy's button, is steadily increasing; yet even the most ardent adherents of the button still wish for improvements in these mechanical devices. There is to be expected, therefore, a number of new proposals along this line. It will be some time, however, before an absolutely complete method of intestinal anastomosis is found. New buttons are constructed, new methods proposed, tried practically and reported statistically, but the final healing processes have heretofore been but little studied, nor has the functional

ability of the applied anastomosis been tested experimentally. In fact, practical proofs of the value of individual methods are lacking.

The author has conducted a series of experiments which, perhaps, will serve to give a clear idea of the different methods of intestinal anastomosis. He first applied the different methods of intestinal anastomosis to a large number of animals, with the view of examining them microscopically after different intervals of time. There are, indeed, some works referring to the examination of bowel union after various periods of time, but these consider either only one layer of bowel (Ritschel-Kuleon's *Archiv*, cix, p. 507; Cornil, *Bulletin de l'Académie de Médecine*, 1896, xxx) or do not take into account the latest and most important studies (Rindfleisch, *von Langenbeck's Archiv*, xlv, p. 600).

In the author's experiments, in the cases in which suturing was done, the method followed for many years in Mikulicz's clinic, and which corresponds essentially to Albert's double suture (*cf.* von Fray, "Ueber die Technik der Darmanhalt," *Beiträge zur klinischen Chirurgie*, xiv, p. 43), employing continuous instead of button sutures, was used. In addition, in other cases, the buttons devised by Murphy, Frank, and other surgeons, were employed, the authors' descriptions being exactly followed.

The result of the microscopic findings, which were made in conjunction with Dr. Reinbach, will be reported at another time. This admitted of a study of the firmness and reliability of the bowel union only in an indirect way; the author therefore decided to add other experiments which should lead to definite and practical deductions.

At first the strength of the anastomosis was tested by means of direct mechanic traction at one end of the bowel-loop, and the fastening of weights to the other end. These experiments were inexact and unsatisfactory.

Much more exact, however, were the results of those experiments in which were ascertained the amount of water press-

ure which the anastomosis could stand without breakage. These tests could be easily made and the pressure conveniently measured; in addition, the results were more satisfactory as the least leakage was readily recognized by the escape of the fluid. Of course, even this method is not entirely free from criticism, and cannot be used in the human subject. The same anastomoses were performed on fresh human cadavers and upon dogs for purposes of comparison.

In order to obtain intestines of approximately the same tenacity, dogs of equal (medium) size and weight were selected. The dogs were narcotized at periods from a few hours to days or weeks following the operations, and the bowel union examined manometrically with the animal still alive.

A loop of intestine, in all cases twenty centimetres in length, including the site of anastomosis, was connected by means of a V-shaped pipe, with a mercurial manometer on one end and the water tube upon the other. In this way it was first ascertained that intestinal anastomosis in the recently dead dog tolerates a rather high pressure (150 to 350 millimetres hygrometrically); in the recent human cadaver rather less pressure is tolerated (110 to 200 millimetres hygrometrically).

In the human bowel the intact intestinal wall along-side of the anastomosis was torn earlier than the site of anastomosis itself. Recent intestinal unions in the dog, applied in the living animal and examined at once, appeared to be less resistant than those in the bowel of the dead dog.

The firmness of the intestinal anastomosis applied in the living dog diminished continuously for the first four days. During the first twenty-four hours it diminished only moderately, unless the peritoneal inflammation due to the operation was very severe at the site of the anastomosis and its neighborhood (100 to 200 millimetres hygrometrically); if the loops of anastomosis were markedly reddened or otherwise considerably altered, the firmness of the anastomosis diminished surprisingly after twenty-four hours (20 to 100 millimetres hygrometrically); forty-eight hours

following operation, in case of slight inflammatory reaction, the resistance was still less (80 to 120 millimetres hygrometrically), and diminished still more during the next twenty-four hours. On the third and fourth twenty-four hours, the lowest resistance was regularly reached (50 to 90 millimetres hygrometrically).

On the fifth day the resistance to pressure increased (50 to 120 millimetres hygrometrically), and on the seventh day increased to the resistance of the recent anastomosis (150 to 340 millimetres hygrometrically). Twenty-four days following, the original resistance was increased (250 to 350 millimetres hygrometrically).

Ten days following operation, the intact bowel tore before the site of anastomosis gave way (height of pressure, 380 to 400 millimetres hygrometrically); and on the fifteenth day in only one case did the anastomosis tear before the uninjured bowel-wall. Thirty days after operation, and in one case 120 days after, the resistance of the site of anastomosis and the bowel-wall was nearly equal.

At first sight it is surprising that such low pressure will tear the anastomosis between the third and fifth day. One would imagine that the solidity of the anastomosis would steadily increase. This can be readily explained. During the first two days the parts are fixed mechanically by the suture or button. The parts gradually become infiltrated and consequently less resistant, thus offering a less secure hold for the fixing elements. Every operator knows what small resistance most tissues possess two to five days after a trauma. In the intestinal wall the conditions are similar.

Further, the author adds, anastomosis by button did not differ materially from anastomosis by suture; either was torn by approximately the same amount of pressure. In case of simple mechanic traction the anastomosis by button gave way earlier, especially those in which the button was cast off or absorbed before the fifth day. Attention is drawn to the fact that certain cases in which the Murphy button was used, even in cases of

recent anastomosis, while the anastomosis gave way sufficiently to allow the button to show, yet no fluid escaped for some time after. This is accounted for by the integrity of the purse-string suture fastening the intestinal wall to the button.

As a general rule, circular anastomosis stood a higher pressure than lateral. In recent anastomosis, done by suturing, the site of rupture was almost always at the point where the knot of the continuous suture lay. This was particularly so if two knots lay together. If the continuous sutures were first tied separately and then together the perforation was always at this point.

All the anastomoses were exceedingly fragile from the third to the fifth day. In two cases, in spite of the greatest care, the anastomosis was torn before the manometer examination. Adhesions to neighboring structures, especially to omentum, were regularly present. During the first few days the site of anastomosis was found almost entirely encircled by portions of the greater omentum. Later, after weeks and months, these adhesions were less numerous, but in only two cases were they entirely absent. In one case, the serous surface being scarified after Wölfler's method, the adhesions were so numerous that it was extremely difficult to identify the site of anastomosis. Anastomoses, the seat of adhesions, withstood a higher pressure than those not so supported. In one case the author sutured a small flap of the greater omentum around the site of a button with excellent result.

In regard to button methods, the author's results were not so favorable. He concludes that a button must stay in a dog's bowel for at least five days, protecting the site of anastomosis in a purely mechanical manner; if left longer than a week, it is apt to cause necrosis. In one case a Murphy button passed *per anum* three days following its application,—that is, at a time when its presence was most essential. In another case it caused perforation on the third day. The result with decalcified bone button was still more unsatisfactory. All of these absorbable buttons, particularly Frank's, were absorbed early, or soon passed in a

half-digested condition. Hardening in formation or partial decalcification afforded but slight improvement.

In two children, the subjects of gastric fistula, because of stenosis of the cesophagus due to potash burns, the author had the opportunity afforded of introducing into their stomachs small undecalcified bone olives. These were in a stage of advanced digestion after two or three days. Decalcified bone olives, left in the same time, became as soft as butter. In the colon, however, they remained unaltered for from seven to ten days.—*Centralblatt für Chirurgie*, 1899, ii, p. 33-37.

RUSSELL S. FOWLER (New York).

GENITO-URINARY ORGANS.

I. Ectopia of the Bladder and its Operative Treatment. By DR. ED. MAZEL (Prag). The motive that prompted this exhaustive *résumé*, covering the entire range of literature, is based upon two successfully operated cases by Professor Wölfler of Prague.

The operation consisted in a resection of the bladder, with the preservation of the trigonum Lieutaudi. The peritoneal cavity, if not previously exposed, is now entered, and the trigonum, being twisted about 90 degrees, is so implanted into the sigmoid flexure that the ureters lie above each other instead of side by side. From the site of implantation a wick of iodoform gauze is led into the wound, which is partially closed by tier sutures, and the remainder drained by iodoform gauze. A couple of pages are devoted to a historical sketch of this affection, and then follows a lengthy consideration of the evolution of the operative procedures that culminated in this radical method.

Within the last six years fourteen cases have been operated by this method, with the surprising figure of 85.7 per cent. cured. But two cases terminated fatally, one several hours after operation, from protracted chloroform narcosis, and the other case succumbed to a pyelitis, fifteen months later.

The author would have neither one of these fatalities looked upon as derogatory to the operative intervention in a malady usually terminating fatally when left to itself, and he foresees a reduction of mortality to a minimum in an early operation so as to forestall that infection of the uropoietic system, which must needs follow from the exposed surface of the exstrophied bladder. In summing up, the author claims as an advantage for the ideal method (plastic operation) the preservation of the bladder, which organ is physiologically ordained to hold the urine, but incapable of doing so, because of the imperfect action of the sphincter vesicæ. On the other hand, in the radical method the bowel is used as a reservoir, not adapted by nature for this purpose, yet with the decided advantage of providing a continence of urine.

The burden of proof, therefore, rests with the ideal method, inasmuch as it has yet to be proven that with the formation of a bladder continence can be secured.—*Beiträge zur klinischen Chirurgie*, Band xxiii, Heft 3.

MARTIN W. WARE (New York).

II. Endotheliomata of the Testes. By DR. KROMPECHER. A critical survey of the literature and a thorough examination of fourteen testicular tumors led the author to the following conclusions:

(1) Testicular tumors of epithelial origin (adenomata, adenocarcinomata) are much rarer than those of non-epithelial origin.

(2) Most of the non-epithelial tumors arise from the endothelium of the lymphatics (endotheliomata), fewer from the connective tissue (sarcomata).

(3) In lymph endotheliomata, arising from the larger lymph-spaces, the origin of the cells from endothelium can be traced directly.

(4) In the lymph endotheliomata, arising from the smaller lymph-spaces, the origin of the cells cannot be absolutely observed, but everything points to their endothelial genesis.

(5) Some of the endotheliomata, arising from the smaller lymph-spaces, exhibit a diffuse structure and correspond to the "lymph adenomata" of the French, others exhibit an alveolar structure and correspond to the "alveolar sarcomata" of Ehrendorfer.

(6) Endotheliomata with alveolar structure are the most common malignant tumors of the testes.

(7) Neither the term "endothelioma" nor "angiosarcoma" should be discarded, since both take cognizance of fundamental peculiarities; "endothelioma" shows the genesis of the tumor, and is adapted to indicate tumors of endothelial origin; "angiosarcoma" takes note of morphological peculiarities, and is a good title for tumors arising from vessels.

(8) Sarcomata and endotheliomata differ clinically from carcinomata in the following points: (a) They generally occur in childhood or before the fortieth year; (b) they generally are of very rapid growth; (c) they have a smooth surface; (d) the albuginea and the skin are generally preserved; (e) the cord is generally unaffected; and (f) the primary seat of the tumor is usually the epididymis.

(9) Some of the endotheliomata, arising from the larger lymph-spaces, are of remarkably slow growth.—*Virchow's Archiv*, Band cli.

JOHN F. BINNIE (Kansas City).

REVIEWS OF BOOKS.

SURGERY OF THE RECTUM AND PELVIS. By CHARLES B. KELSEY, A.M., M.D., Professor of Surgery at the New York Post-Graduate Medical School and Hospital. Royal 8vo, pp. 573; illustrations, 281. Brooklyn: W. B. Dalston, 1898.

About ten years ago Dr. Kelsey published a volume entitled "Diseases of the Rectum and Anus." It was well received, and a number of editions successively appeared. A wider range is now taken, and a comparison of the book and title of the two will show at a glance the increased scope of the present volume.

Experience has shown that in actual practice diseases of the rectum cannot be separated from so-called gynecology and genito-urinary diseases, and in the present instance such purely artificial distinctions are not attempted, and the diseases of the pelvis are considered as a group of closely allied affections

As in his former volume, the fundamental support upon which all that follows is based is found in the opening chapter, treating of the anatomy of the pelvis and the organs therein contained. The illustrations are numerous, and the complex of muscles, vessels, and viscera comprising and overlying the perineum is well considered.

The general rules regarding examination and diagnosis which are formulated in the succeeding chapter are worth careful study and wider application. "Patients, male or female, who have not yet come to the point which makes them willing to submit to an examination, have not yet reached the point which admits of treatment." "The secret of successful diagnosis of diseases consists in taking nothing for granted." These state-

ments are truly axiomatic, and should form a part of every medical creed.

More specific directions are equally good. "There are three classes of cases in which an enema is indispensable,—those in which a protrusion is caused at stool, which cannot be produced at will with the patient on the table; those in which the rectum is so filled with *fæces* that no examination is of any value; and those in which it is desirable to make a visual examination very high up or to pass the rectal sound." "The old-fashioned red, hard-rubber bougie is unnecessarily stiff and dangerous, and should be discarded, having no advantages over the softer ones, either for the purpose of diagnosis or for that of treatment. The better fitted a bougie is for allowing the use of force, the more dangerous it is." "For diagnostic purposes in ordinary cases every form of speculum should be abandoned unless ether is administered at the time." "There are but three ways of making a diagnosis,—by question, by sight, by touch. The man who has exhausted these will seldom fail, and should he do so, need not be ashamed. The man who neglects any one of them will sooner or later make some error which he might easily have avoided."

Equally explicit directions are given regarding operations. "There is no detail of antisepsis which cannot be perfectly carried out in any private house with sufficient care and trouble." The surgeon and his assistants, the ligatures and sutures, the dressings and the instruments are all considered.

Congenital malformations, and the various procedures adopted for their relief, are treated before speaking of acquired lesions, such as proctitis and abscess. "The treatment of deep abscess may now be described in two words,—incision and drainage." In speaking of the treatment of similar affections in women this statement is made: "In every acute case due to an endometritis, whether gonorrhœal or post-partum, the treatment should be commenced by curettage." That this is good doctrine in the former variety of endometritis is not to be debated, but the curettage of a post-partum uterus before the more simple, far less dan-

gerous, and equally effective procedure of passing the hand into the vagina and, with the fingers in the uterus, removing placental or other *débris* from the uterine cavity,—courage in fact,—has been tried, is certainly *not* to be recommended.

The various forms of vaginal and abdominal hysterectomy are included in the chapter devoted to pelvic abscess in women. Numerous semidiagrammatic illustrations well show the technique of each method.

Fistula and hæmorrhoids are the next conditions to be described, and here the author appears at his best. His wide experience enables him to cite actual cases which illustrate all of the less common varieties and complications of these conditions, and also of the closely allied diseases of prolapse, non-malignant neoplasms of the rectum and anus, and the various forms of ulceration which occur in this region.

Cancer deservedly receives a thorough discussion, and the different operations for its relief are fully described. The list includes Kraske's operation and others of similar aim, the formation of an artificial anus, intestinal resection, and intestinal anastomosis. Unlike some writers, Dr. Kelsey does not attempt to advocate any one operation to the exclusion of all others, but rather to present the advantages and disadvantages of each in a given case, and let the choice be made upon the merits of each. In giving a general conclusion he agrees with the dictum of Van Buren,—“To do any good we must still confine our operations to cancer of the gut, and not of the gut and surrounding tissues, and to an early stage of the cancer at that.”

In the chapters devoted to so-called gynæcology, the diseases of the ovaries and tubes, and the operations for their relief or removal are, of course, separated from the other operations on the region, but plastic operations upon the vaginal walls and the closely adjacent tissues of the perineum are properly grouped together.

The radical cure of hernia is discussed, and especial stress laid upon the operations of Bassini and of Halsted.

The surgical diseases of the genito-urinary tract, in both male and female patients, form the closing chapters, and include the operations for epispadias as well as nephrectomy.

The concluding chapter upon appendicitis contains a good digest of our knowledge of the subject. His statement "that the intelligent surgical treatment of appendicitis consists much more in knowing when to operate than in opening the abdomen" is one which some of our over-enthusiastic surgeons would do well to bear in mind, and apply to a great variety of conditions which may or may not require an operation.

HENRY P. DE FOREST.

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ANNALS OF SURGERY,

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ON TWO CASES OF TRAUMATIC RUPTURE OF THE COLON,

WITH SOME REMARKS ON THE CASES OF RUPTURE OF THE IN-
TESTINE TREATED IN THE WARDS OF ST. THOMAS'S
HOSPITAL, LONDON, BETWEEN THE YEARS
1889 AND 1898, INCLUSIVE.

By GEORGE HENRY MAKINS, F.R.C.S.,

OF LONDON,

SURGEON TO ST. THOMAS'S HOSPITAL.

DURING the past three years it has fallen to my lot to treat two cases of rupture of the ascending colon, and these, though differing widely in their course and nature, both ended successfully.

The first case has been already included in a short account of three abdominal injuries published in the *St. Thomas's Hospital Reports*; but in preparing the notes of the second case for publication, it occurred to me that it would materially add to its value if I took the opportunity of adding to my account some remarks on the subject in general, gleaned from the experience gained in these injuries, since a definite line of treatment has been the rule in the hospital.

The series utilized for remark commences from the date of the already classical case of Mr. Croft, the first rupture of the intestine successfully treated by suture, and includes all those which have since been under treatment in the hospital. Many of these have been already published as isolated cases, but no attempt has been made to glean general information from them, and it is evident that since the adoption of abdominal section as a routine treatment we are in the possession of a considerable amount of knowledge as to the early condition

of the abdominal cavity after such injuries, which was wanting when the post-mortem room furnished the sole field of study. On some points as much information as might be wished is wanting, as the result of the notes of the cases being the work of different persons, and not having been made with any special object in view; none the less, it seems to me that several important points are suggested by them, and that, in the present state of our knowledge, any contribution tending to throw light on a class of injury which has so lately proved itself capable of successful treatment will be acceptable.

I will first detail the history of my most recent case, which is shortly as follows:

A healthy man, aged twenty-six years, while steadying a log, about three feet in diameter, on the table of a circular saw, received a blow in the right flank as a result of the log being thrown suddenly backward by the machine.

The patient was thrown down, but did not lose consciousness; in a few minutes he commenced to vomit, and this symptom continued during the forty-five minutes employed in bringing him up to the hospital.

On his arrival he was evidently in great pain, his face was pale although not blanched, the eyelids were half closed, and his skin was moist with perspiration. When laid on the couch he seemed dazed, but answered questions intelligently. The breathing was shallow and rapid, occasionally accompanied by a half-suppressed groan; he lay with the knees drawn up; the pulse was 88, regular, and of good volume; the temperature slightly subnormal.

On inspection of the abdomen a slight graze, about two inches in length, was seen extending obliquely downward and inward from a little above the anterior superior spine of the ilium, in the line of Poupert's ligament. The abdominal wall was rigid and scarcely moved with respiration. There was no distention. General abdominal tenderness was complained of on palpation, but the most tender spot was in the right iliac region. No emphysema was present. On percussion, the liver dulness was normal, but there was slight impairment of resonance in the right loin. A specimen of clear normal urine was removed with the

catheter. Matter vomited on admission consisted of partly digested food and was clearly gastric in origin.

During the next six hours the condition increased in gravity, the patient continued to vomit frequently, the voided matter assuming a green color, but remaining inoffensive in odor; the rigidity of the abdominal wall varied a little in degree at times, and no evidence of free fluid in the abdominal cavity developed. The face became flushed and anxious, and the patient sweated freely, while the pulse increased in frequency, at the same time losing in strength.

I was called to see him at 10 P.M., and an hour later he was brought into the operating theatre.

A median incision was made below the umbilicus and the belly opened. The presenting omentum was slightly ecchymosed, and a small quantity of muddy-brown fluid escaped; as the pelvis was reached the latter became distinctly fæcal in odor, and in this region the intestines were coated with thick patches of plastic lymph. Exposure of the cæcum led to the evacuation of a blood clot of the size and shape of a finger, and this portion of the colon was of a dark-red color from ecchymosis and congestion. On the anterior aspect of the cæcum the peritoneal coat was rent in a longitudinal direction for a length of two inches, while at its lateral aspect, at the junction with the ascending colon, a somewhat valvular opening, about three-fourths of an inch long, was found to perforate all the coats of the bowel. From the latter opening a small amount of fæcal matter had escaped, and gas passed out freely, while a track of cellular emphysema extended along the side and back of the colon, and a considerable retroperitoneal hæmorrhage was found in the iliac region. The neighboring parts of the peritoneum were cleansed by sponging, and both the incomplete and the complete rents repaired by the passage of Lembert stitches. The bruised portion of the omentum was then removed, and the belly cavity generally flushed with sterilized water. Bearing in mind the impossibility of rendering aseptic the track of cellular emphysema in direct continuity with a considerable retroperitoneal hæmorrhage, it was thought well to introduce a large gauze plug, and bring it out at the lower angle of the central line incision. For convenience in manipulation it had been found necessary to extend the original incision across the right rectus muscle, and this, together with the part of the

wound not occupied by the plug, was now united with sunk sutures.

Little shock was noted during the operation, but after removal to bed the pulse rose to 160, and a very restless night was passed. During the night the temperature rose to 100° F., but there was no return of the vomiting, and small quantities of warm water were allowed to be swallowed.

During the second day a general improvement was noted, the pulse falling to 82, and the patient complaining little. The belly was soft and the respiratory movements, though shallow, were not entirely thoracic. In the afternoon a little milk was given, but it was not retained, and a pint of warm water was therefore injected into the rectum to relieve thirst. There was little pain or tenderness. Twenty-four ounces of normal urine were passed. The wound was dressed and the plug withdrawn, and as the latter was odorless, and no escape of fluid followed its withdrawal, it was not replaced, and the wound was completely closed.

In the evening the temperature rose to 101.5° F., the pulse again increased to 120, the respirations rising to 32. A fair night was passed, however, and on the morning of the third day his condition was most satisfactory, the pulse having again fallen to 86, the respirations to 28, and the temperature to 100° .

Milk and water was now given by the mouth, but it was occasionally vomited, and during the day distention of the abdomen rapidly increased.

In the afternoon of this day the patient's appearance suddenly altered greatly for the worse, the face became anxious and somewhat livid, distention was marked, and he complained of pain. The question of the failure of the suture or the development of peritoneal septicæmia was now considered, and the latter decided upon; two and a half drachms of sulphate of magnesia was therefore administered by mouth, and retained. A long tube passed into the rectum failed to give any relief, and as the bowels did not act, this was followed by the administration of an enema of soap and water, after which a free evacuation occurred, giving much relief. Pain, however, continued, and nourishment was taken badly. The amount of urine secreted gradually increased in quantity, amounting to thirty-eight and thirty-four ounces for the two days.

During the fourth and fifth days little improvement was

noted, the anxious expression was retained, and there was still some distention; the upper part of the abdomen, however, became quite flaccid, and moved freely with respiration. The pulse ranged between 68 and 80, the temperature averaged about 100° F., and a fair quantity of urine was passed. A great aversion to milk was developed, but eggs, Valentine's meat-juice, and brandy were taken well, and there was no sickness. During both these days a drachm of sulphate of magnesia was given every four hours, but the bowels did not again act until the night of the fifth day, when they were open five times, and fifty-four ounces of urine were passed.

On the sixth day a very marked improvement was noted, the patient awoke without the anxious expression, the abdomen was flaccid and moved freely, and the only unpleasant symptom consisted in tenderness and impairment of resonance in the right iliac fossa.

On the morning of the seventh day there was fluctuation evident at the lower angle of the abdominal wound, and a director inserted here released a considerable quantity of foul-smelling pus, which welled up upon pressure in the right iliac region.

From this date no further symptoms were developed, the temperature, pulse, and respirations became normal, the bowels acted daily, a normal amount of urine was secreted, and strength was rapidly regained.

The wound ceased to discharge, and healed at the end of a fortnight, leaving some induration, which, however, also disappeared before he left the hospital, on the fortieth day.

The man has since remained in good health, and resumed his ordinary occupation.

The above case offers some points of special interest, and the more so since the course to recovery was not a continuously successful one.

The history is an unusual one, the force being severe and applied to a strictly local area, the latter, moreover, being marked by a distinct local abrasion.

The patient was fortunate in coming early under observation, the operation being undertaken seven hours after the injury, and this was the more important, since the escape of

intestinal contents was somewhat freer than is apparently usually the case.

The indications for exploration were the nature and history of the injury, frequent and early vomiting, early development of rigidity of the abdominal wall, local tenderness, and impairment of resonance in the right iliac region, the absence of definite signs of injury to the urinary bladder or solid viscera, combined with the evidence of serious injury as indicated by the degree of shock, abdominal pain, rising pulse, general pallor, and perspiration.

A median incision was chosen; as events turned out, one in the right iliac fossa would, perhaps, have been preferable, as the wound had to be extended laterally.

On opening the abdomen, the striking points were first the well-marked faecal odor of the fluid met with, and, secondly, the large amount of plastic lymph developed on the surface of the coils of small intestine, lying in the right iliac region, and the pelvis on the right side.

The rent in the bowel was in some respects a peculiar one; both aspects of the tube were injured, the anterior, probably the one first impinged upon by the force of the blow, had escaped with a longitudinal rent of the peritoneal covering, while the posterior one, as being directly driven against the ilium, had given way entirely at the point of reflection of the peritoneum to the abdominal wall, no doubt a weak spot, as the meeting-place of two parts of the intestinal coats of varying strength.

As was shown by the presence of emphysema of the cellular tissue of the ascending colon at the time of operation, and by the subsequent suppuration, this location of the rupture was most unfortunate, both as rendering immediate cleansing impossible (since it is evident that where air could permeate septic fluids could also readily pass, and this into a tract of tissue already occupied in part by extravasated blood, a most favorable medium for the development of septic organisms) and as rendering future suppuration almost certain. In this respect, I think, there can be no doubt that an uncom-

plicated intraperitoneal rupture is to be preferred to a mixed one, such as we are considering.

The method of suture chosen is, I think, the best, and preferable to any in which portions of the bowel are cut away, except in instances where wide-spread, severe contusion or complete transverse rupture has occurred.

The method of cleansing—although in the circumstances of this case detective—is also to be preferred, as a rule,—viz., first dry sponging of the evidently fouled area, followed by irrigation of the neighboring parts with sterile water, or preferably sterilized normal saline solution.

The introduction of a gauze plug, although sometimes unnecessary, was clearly indicated in this case. The only error was in not replacing it at the time of the first dressing, or, at any rate, leaving it longer in place. None the less, I think the plug must have the credit of having determined the course taken by the pus to the lower angle of the wound, where it was eventually evacuated.

The last point to which I will refer is the treatment of the peritoneal septicæmia by the administration of a saline purgative. I attribute great importance to this, and shall refer to it again in a later part of the paper.

I will now pass to the consideration of some general points raised by the examination of the details of the twenty-one cases that have come under treatment in St. Thomas's Hospital during the past ten years.

Frequency of Occurrence of Ruptures of the Intestine.—During the ten years under consideration, 8153 cases of injury to various parts of the body were treated in the hospital, and of these 292, or 3.59 per cent., were injuries of varying degrees of severity of the abdomen.

The subjoined table shows that of the whole number of abdominal injuries eighty-nine were ruptures either of abdominal viscera or the urinary bladder, thus 30.47 per cent.

Further, that of the eighty-nine cases, twenty-one—or 23.59 per cent.—were ruptures of the intestine.

The order of frequency of the visceral ruptures comes

out as follows: Kidney, 39.32 per cent.; intestine, 23.59 per cent.; liver, 16.85 per cent.; spleen, 11.23 per cent.; bladder, 5.61 per cent.; mesentery, 3.27 per cent. The relative frequency of injury to the kidney, it need hardly be pointed out, is probably due to the fact that the organ may suffer whichever flank is injured.

TABLE SHOWING TOTAL NUMBER OF INJURIES FROM 1889 TO 1898.

Year.	Total Injuries.	Abdominal Injuries.	Liver.	Kidney.	Spleen.	Bladder.	Mesentery.	Intestine.	Wound of Intestines.
1898	815	43	3	6	.	1	. . .	6	.
1897	787	34	3	4	2	1	. . .	3	1
1896	772	30	3	4	2	.	2	1	1
1895	816	46	1	9	4	1	. . .	3	. . .
1894	901	25	2	2	1	1	. . .	1	1
1893	932	32	1	3	.	.	1	.	.
1892	779	17	1	2	1	.	.	2	.
1891	809	34	1	1	.	.	.	2	.
1890	749	10	.	.	.	.	.	2	.
1889	793	21	.	4	.	.	.	2	1
Total . .	8153	292	15	35	10	4	3	22	4
Per cent.	. . .	3.59	16.85	39.32	11.23	5.61	3.37	23.59	

Causation.—The series throws little fresh light on this point, as in the older collections of cases we find that the one factor of importance is that the violence should be severe and localized in its action to a small area. Thus, of twenty-one cases, six were the result of kicks by horses; five patients were run over; four fell (one onto an anvil, one with a second man across his belly, one from a window across an iron railing, and one from a van); two patients were caught between buffers; one was struck by the end of a plank on a sawing machine; one was pinned by the pole of a van against a wall; one was struck by a falling box; and one was caught and rolled between two passing railway trucks.

Part of the Intestine Injured.—On this point the present series throws a very important etiological light. In the older series the relative degree of fixation of the bowel has always been upheld as one of the most important factors, and

an immense numerical proportion of instances of rupture of the small intestine has been recorded. Thus, of 116 cases collected by Curtis, no less than 112 are ruptures of the small gut. That the small intestine, by reason of its comparatively exposed position, is specially liable to injury cannot be doubted, but I shall hope to show that the most important factor in determining injury to the bowel is that the injury should be received in the lower half of the abdominal cavity, and, this being the case, that the large bowel in some situations is quite as liable to be injured as the small.

In the series of twenty-one cases under consideration, the rent was situated in the small intestine in sixteen; in the large, in five instances. This proportion may be incorrect, from the small number of cases under investigation, as I am inclined to think is the case with Curtis's numbers; but I will only say with regard to the present series that the observation extends over ten years, and has been made on the material derived from a large city, hence it has at any rate some definite value. As will be seen later, the large bowel was, however, injured in two cases as the result of abnormal mobility due to elongation of the transverse mesocolon, and although this places the two cases in the same category as injuries of the small gut, yet it must be borne in mind that a U-shaped colon is a fairly common condition in the subjects of chronic constipation or omental herniæ.

The actual localization of the injuries was as follows:

Duodenum, one, retroperitoneal, five inches from pylorus.

Jejunum, six, sixteen inches from pylorus; twenty and thirty inches from pylorus; four feet from pylorus; six feet two inches from pylorus; eight feet from pylorus; ten feet ten inches from pylorus.

Ileum, seven, twelve feet ten inches from the cæcum; three feet eight inches from the cæcum; one foot six inches from the cæcum; one foot from the cæcum; nine inches from the cæcum; six inches from the cæcum; distance not determined.

Colon, five, junction of ascending colon and cæcum; as-

cending colon, lower part; transverse colon, two; sigmoid colon.

Small Intestine, two, actual point of injury not determined.

Locality in which the Occasioning Violence was exerted.—

In nine cases the exact point of impact was indicated by a local bruise or abrasion, and in eight of these the seat of injury was situated below the level of the umbilicus. In three cases it is definitely stated that no bruise existed, but in one of these (a buffer accident) a local, tender spot below the umbilicus indicated the point of injury, and in the other two (the result of horse-kicks) the history definitely localized the point struck as just within the anterior superior iliac spine and below the umbilicus, respectively.

In seven cases no mention is made of a bruise or abrasion; in one of these, however, a definite tender spot above the pubes was stated to have been that struck by the horse's shoe; in five (run over, fall from van, pinning by van pole, blow from falling box, fall with man across belly) no mention is made of either local bruising or tenderness, and in one (horse-kick) it is definitely stated that neither bruising nor tenderness existed.

In the case of subperitoneal injury to the duodenum cellular emphysema indicated broadly the locality of the rupture.

Consideration of the above points shows that the actual determining elements as to the part of the intestinal tube likely to be injured are that the violence should be exerted on that part of the belly cavity supported by a bony wall posteriorly, and, hence, that the bowel to be injured should either be fixed in the lower half of the abdomen or possess a sufficiently long mesentery to lie in that region.

Examination shows that a very large majority of the injuries of the small intestine were either to that portion of the ileum always situated in the iliac or hypogastric regions, or to those portions of the ileum or jejunum normally provided with the longest mesentery, thus only two cases of injury to the jejunum were within two feet of the pylorus.

In the case of the large intestine these points are still more strongly marked; thus, one injury is to the junction of ascending colon and cæcum; one to the lower part of the ascending colon; one to the sigmoid colon, parts always situated in the lower half of the abdomen; and the other two were of the transverse colon; in each case the colon being of the U-shaped arrangement, and situated just above the pubes, and therefore in the dangerous area.

The localization of the one injury to the duodenum can clearly also be ascribed to the locality in which the violence was exerted.

Fixation of the bowel is then only to be regarded as of secondary importance, as preventing the escape of any part by gliding away on the application of violence, while length of mesentery and consequent freedom as to location, whether normal, as in the case of the small intestine, or acquired, as in the case of the U-colons, is of greater importance, as allowing any given portion of the bowel to lie in the dangerous area. In making this general statement, of course, exception is made to the rare instances of rupture of the duodeno-jejunal junction as a result of falls from a height to the feet.

Speaking broadly, I think it may be with certainty affirmed that blows over the abdomen, above the level of the umbilicus, are very unlikely to cause a rupture of the intestine, unless the violence be so directed as to allow the gut to be directly compressed against the spinal column, a matter of some rarity, and, secondly, that if blows so directed are received, an injury to the mesentery or omentum is at least equally probable as one to the bowel itself.

Violence applied to the loins is unlikely to be dangerous to any part of the intestine, except the posterior aspect of the colon or duodenum.

The column of the table devoted to the actual nature of the rent affords little new information, but we find examples of every form of the injury before described; thus, in two cases the rents were multiple, in two the bowel had undergone complete transverse division, two were transverse, seven

longitudinal rents, and in seven cases the rupture took the form of a contused hole, varying in size between a minute opening, sufficient to allow the escape of fluid, to one the size of a threepenny piece, surrounded by a considerable area of ecchymosis. In two cases the direction of the rent is not stated.

On the column devoted to the intestinal contents found in the belly at the time of operation I should like, however, to make one remark. Since the time of the classical experiments of Travers we have been well acquainted with the facts that contraction of the muscular coats and eversion of the mucous membrane tend to prevent the escape of intestinal contents, yet the term *fæcal extravasation* is often made use of in speaking of these injuries. Examination of our table shows that in no case did the amount of actual *fæcal* matter deserve such a significant term. In the majority peritoneal infection would be a more fitting description of what had occurred. I mention this, however, not so much as a matter of importance in description as to draw a comparison with the different state of affairs which exists when an opening in the bowel or stomach is the result of the perforation of an ulcer, in which case, from the different nature of the opening, escape of intestinal contents is a prominent feature, and consequently free fluid and gas in the belly give rise to early and well-marked clinical signs absent in most cases of traumatic rupture.

Case VII, in which a secondary operation was done on the third day in consequence of signs leading to the belief that the suture was incompetent, as was indeed the case, throws an illustrative light on this point, since, at the primary operation, only blood is spoken of as found in the peritoneal cavity, while at the second operation a considerable amount of intestinal contents is noted to have escaped from an ulcerating suture hole.

Table II is devoted to a tabular list of the symptoms observed, and, although they offer little diagnostic help, I will shortly analyze them before proceeding to the questions of diagnosis, prognosis, and treatment.

(1) *Shock*.—The degree of shock, as in all serious abdominal injuries, was very variable; in six cases it was severe, being spoken of as “collapse” at the time of admission, and two patients were rendered temporarily unconscious as a result of the injury. On the other hand, in eight cases it is reported as “slight”; in three no mention is made of it as a prominent symptom; and in three it is definitely stated that “no shock” was evident at the time of admission. A certain degree of pallor, often marked and accompanied by sweating, is, however, in my experience, a common condition.

(2) *Abdominal Pain*.—This is a constant sign, but not always continuous, and often not severe. As a rule, the patients came under observation at intervals varying between three-quarters of an hour and four hours after the accidents. Three patients offered no opportunity of observation on this point, since they were admitted on the second day or later.

Early pain is noted in seventeen cases, but in six of these it was not severe, and in three of the remainder it subsided rapidly, to reappear, in two instances, at the end of twenty-four hours, and in a third on the third day,—that is to say, with the development of signs of inflammation. In two cases, again, early tenderness and rigidity were more prominent symptoms than actual pain.

In only two cases is the pain definitely described as “severe,” but it must be remembered that in at least six of the cases shock was a marked feature on admission and for some time later.

Variability of degree in this symptom, in the early stages, is to be ascribed to the relative amount of injury to surrounding structures, and the degree of severity of the shock present; in the later stage, when pain depends on the development of inflammatory changes, the want of uniformity corresponds to what is seen in other cases of peritoneal septicæmia.

(3) *Rigidity and Immobility of the Abdominal Wall*.—Both these signs may be regarded as almost constant, but they are naturally not pathognomonic to the injury.

On examination of the table we find that early rigidity was present in thirteen of the cases,—that is, two to four hours after the injury,—in four cases there was no rigidity on admission, and this sign only developed some hours later (thus seven to eighteen hours). In three cases the respiratory movements are described as good. Three patients came under observation on the second, third, and fifth days, respectively; in all the abdomen was rigid on admission.

One or two remarks may, however, be made on these signs, first, the degree of rigidity is apt to vary somewhat frequently during the course of the early hours, and, secondly, the cessation of abdominal respiratory movement gradually follows the development of rigidity, movement persisting in many cases in the upper segment of the belly wall for some time. The latter rigidity is more constant, and accompanied by a considerable increase in the frequency of the respirations; these signs are to be regarded, however, rather as indicative of the development of peritoneal septicæmia than of localization of the injury to the bowel.

(4) *Abdominal Distention*.—This is rarely seen in the early stages, and develops only with the advent of peritoneal septicæmia. In one case it was, however, noted on admission a few hours after the injury; in a second, after a lapse of ten hours; and in a third, after eighteen hours. In all the remainder it was absent, unless the patient lived long enough to develop general evidence of peritoneal septicæmia.

(5) *Abdominal Tenderness*.—In two cases this is mentioned as absent, and in five there is no record of its presence; none the less, it is probably to be regarded as a constant sign, its value being, however, detracted from by the fact that the injury usually present to the abdominal wall often obscures its significance as evidence of injury to deeper structures. In the later stages, it is only useful as a sign of peritoneal septicæmia, assuming a wide distribution and being of little aid as a means of localization.

(6) *Signs on Percussion*.—These are of undoubted value, but, unfortunately, the material at my disposal does not give

very full details. In five no mention is made of the conditions present; in six it is definitely stated that neither dulness nor tympanites was present; in four extensive areas of deficiency of resonance, fixed in position, and most commonly in one or other flank, are described; in four definite local areas of small extent were present; and in one there was emphysema of the flank; in the latter the liver dulness was absent, this being the case of subperitoneal rupture of the duodenum, and the only case in which the latter sign was present.

Of the two variations in local resonance I regard the less extensive as of greater importance; it is to be explained by the local infection produced by the rupture, and is due to effusion and the development of plastic lymph producing early adhesions, and the experience gained by the abdominal sections shows this to be a very early occurrence, at first localized to the seat of injury. The larger areas of dulness are to be explained in another way, and are due to the contraction and collapse of large segments of the small bowel, almost invariably accompanying these injuries. Such contraction may, however, follow other and severe blow or injury to the abdomen; thus I have seen it marked in a case of rupture of the liver and in other injuries, in which the gut itself escaped gross damage. The importance of the sign depends rather on its fixity, which, as indicating its independence of the presence of free fluid in the belly, is an important exclusion sign, since ruptures of the intestine, excluding those accompanied by rent of the mesentery, are rarely the cause of free hæmorrhage, and, as has already been shown, are not followed by free escape of intestinal fluid into the peritoneal cavity.

Tympanites is, as a rule, slight and variable, and can scarcely be regarded as a sign of any diagnostic importance. Absence of liver dulness is very rare.

Cellular emphysema was only twice present, once in the left flank, in the case of ruptured duodenum, and once was only discovered by the abdominal section not having passed the limits of the ascending mesocolon. In the first it was an

important diagnostic sign, and in the second would no doubt have been of diagnostic aid, had the patient not been operated upon before it had had time to extend freely. Its significance is undoubted as pointing to injury of the bowel beyond the limits of the peritoneal coat.

I would again advert, under this heading, to the great difference noted in this class of case, and that in which the perforation is secondary to ulceration, in which latter escape of intestinal contents often gives rise to signs not only of free fluid, but also of gas in the abdominal cavity.

(7) *Pulse and Temperature.*—On these points I may be brief. In all cases the pulse shows a steady tendency to rise in frequency and to lose in strength, practically in an identical manner to that in which it behaves in other cases of peritoneal septicæmia. I shall again advert to this sign as the most important single one in the question of deciding on abdominal exploration.

The bodily temperature is usually low soon after the injury, sometimes reaching the extreme shock limit; later it tends to rise, but the rise is often not striking, amounting to 101° to 102° F. at the most.

Some remarks as to the frequency of respiration have already been made under the heading of abdominal rigidity and immobility, and its twofold significance adverted to.

(8) Lastly, certain other symptoms need to be mentioned, although the cases under consideration offer little information on them. Only one patient, a young boy, expressed an urgent desire to defecate shortly after the occurrence of the injury, and in none is the passage of blood or the presence of tenesmus mentioned. None the less, these signs, if present, may be of definite importance.

Diagnosis.—Consideration of the above analysis of the symptoms supports the view that the diagnosis of rupture of the intestine must, in the great majority of cases, be made by the method of exclusion, and then, in view of the necessity of prompt action, often needs the evidence afforded by an abdominal section to confirm it.

In a case of severe abdominal injury our first care must, therefore, be to exclude the possibility of injury to either of the solid viscera, each of which may be said to possess its early characteristic signs, also possible rupture of the urinary bladder, which often suffers from an injury capable of producing a rupture of the intestine.

The history may aid us as to the actual nature of the violence, which was probably such as to affect a strictly localized area, and as to the exact spot upon which the violence was exerted, while the latter point may be further evidenced by external marks of injury, and the importance of the localization of the causative violence to an area below the umbilicus, in many cases, I hope I have made clear.

Secondly, general symptoms, such as shock, pain, and vomiting, combined with local signs, such as localized tenderness, early rigidity and immobility of the abdominal parietes, and the presence of fixed local areas of dullness, either small, as possibly indicating the locality of the injury, or large and fixed, as indicating collapse of bowel but not the presence of free fluid, will be of aid.

Thirdly, special signs pathognomonic of intestinal injury, such as cellular emphysema, localizing the injury to the uncovered portions of the duodenum or colon, or possibly free gas in the peritoneal cavity, may be present.

Fourthly, the presence of any of these signs with a rising pulse above 100 will be indications for an abdominal exploration.

In closing these remarks it may be of interest to point out that, in spite of careful observation on the above lines, we may occasionally open the abdomen in cases where interference is of little use, and would have been better avoided.

As an instance of this I might mention a case, lately under my care, of a boy, aged fourteen, who had been run over. On admission the boy was pale, sweating, with a pulse of 90, and a temperature of 97.5° F.

There was a mark of the wheel over the left great trochanter,

and another graze over the right anterior superior spine, apparently indicating that the wheel had passed obliquely over the pelvis and lower abdomen. The lower part of the abdomen moved little, and there was some rigidity of the wall. A catheter passed brought off some clear normal urine, and no evidence of fractured pelvis could be made out. After a few hours' stay in bed the boy's condition became worse, his pulse rose to over 100, and at the same time local tenderness and dullness developed above the pubes and in the right iliac fossa. It was thought better to explore the abdomen four hours after admission. A median incision below the umbilicus, however, disclosed the cause of the tenderness and dullness as an extraperitoneal hæmorrhage in the cavum Retzii, and when the peritoneum was opened the cavity was found normal, except for the presence of a small amount of blood-stained fluid. My attention was, therefore, again directed to the bladder, which had been put out of court as a result of the clear urine which had been readily drawn off. An assistant passed a silver catheter for me, which, in place of entering the bladder, passed into a quantity of blood-infiltrated tissue at its base towards the bottom of Douglas's pouch.

An incision carried deeply into the perineum now entered a cavity full of blood-clot, and the catheter was found to escape from a lateral rent of the urethra at the back of the membranous portion. Careful examination by both wounds failed to enable us to discover a fracture of the pelvis, although I still think one must have existed. The abdominal wound was closed, the perineal kept open with a small plug. The after-course was in all respects satisfactory, the boy rapidly improved, and the wound in the perineum healed in ten days. Little urine escaped, and as the rupture was an incomplete one, no contraction of the lumen of the urethra took place.

This case shows how one may be misled by the use of the complex of symptoms above referred to, but may, I think, fairly be considered an unusual one.

A second, of a somewhat more purely abdominal character, may be mentioned; in this, a man aged twenty-four, while riding down a hill on a bicycle, ran against the tail-board of a van which caught him across the epigastrium; he was taken home in a cab,

and during the night vomited frequently, bringing up, he himself said, a considerable quantity of blood.

He was admitted into the hospital on the following day; the face was pale, the pulse full and strong, 80 to the minute, respiration thoracic and hurried. He complained of pain, increased by deep inspiration, and of great tenderness in the epigastrium. There was no distention, but vomiting followed the taking of any nourishment. I was inclined to suspect an injury to the duodenum on the following grounds: seat of injury, early vomiting, possibly in part of blood, and the local pain and tenderness. The man so steadily improved, however, after being placed in bed that it was decided not to interfere with him, and in ten days he was allowed to go home. On the fortieth day after the accident I saw him again, and found that a pancreatic cyst had developed, which was subsequently successfully drained.

Diagnosis from Rupture of the Mesentery.—A definite diagnosis between simple rupture of the intestine and rupture of the mesentery is often impossible, since the two conditions may be present together. One sign, however, is of definite value in localizing injury to the mesentery,—viz., the presence of a large quantity of free blood in the peritoneal cavity. As already mentioned, uncomplicated ruptures of the intestine are rarely accompanied by free hæmorrhage, while this always occurs with mesenteric rents. The difficulty, of course, arises when the injury has been inflicted in certain regions of excluding injury to the solid viscera, but if this can be done, and it can be shown that the injury was inflicted in a region in which the intestine is rarely injured, rent of the mesentery may at least be regarded as possible.

During the period under review three cases of rupture of the mesentery came under treatment at St. Thomas's Hospital; all three were the result of buffer accidents, a not very common cause of rupture of the intestine, and in all three a large quantity of fluid in the peritoneal cavity was a prominent sign. All three showed evidence of unusually severe shock, two dying in a few hours, and never rallying sufficiently to allow of any operation being undertaken, while the

third succumbed twenty-two hours after an abdominal exploration and suture of the rents. In one case two pints of blood were found in the peritoneal cavity at the post-mortem examination, in the second four pints were found, while in the third (that operated upon) a very large amount of blood was evacuated prior to the suture of the rents, and six ounces of blood were still present when the post-mortem examination was performed.

The most important points in the history of such cases would, therefore, seem the localization of the occasioning violence between the levels likely to account for rupture of the liver and spleen above and of the intestine below, and also as accessory the fact that the violence, as a rule, is not of a nature to affect a strictly local area of small extent. Thus Mr. Pitts (*St. Thomas's Hospital Reports*, Vol. xxvi, p. 93), in describing two of these cases, says, "The violence is usually a crush or gliding force, such as a wheel passing over the abdomen."

Prognosis.—As to prognosis in general, considering that up to ten years ago this injury was regarded as a mortal one, the results obtained in the twenty acutely coursing cases must be regarded as highly satisfactory. Of the whole number seventeen died and three recovered,—or 15 per cent.

Of the whole twenty, however, only fifteen were operated upon, with the same number of successes,—or 20 per cent.

A fourth case, Mr. Battle's (*Lancet*, Vol. ii, 1898, p. 1548), might, moreover, be almost regarded as an immediate success, since his death on the twenty-fifth day, from a sub-diaphragmatic abscess, was probably the result of the unfortunate accident of his belly bursting open on the tenth day, during a fit of coughing, for up to that time the progress of the case was all that could be desired.

Sixteen of the twenty ruptures implicated the small intestine; of these two—or 12.8 per cent.—recovered.

The remaining four were of the large bowel, and of these one—or 25 per cent.—recovered.

Average Duration of Life in the Fatal Cases.—In the whole sixteen this amounted to fifty-nine hours twenty-two minutes, omitting one case, which lived twenty-five days. Four other cases, however, lived four, five, six, and nine days respectively, and if these be subtracted also, the average duration of life of the remaining eleven amounts to just forty-eight hours.

In the twelve cases operated upon, the average duration of life amounted to forty-four hours and forty minutes.

In the five cases dying without operation, the average duration of life was eighty-two hours and thirty-six minutes.

If the large and small intestine cases are separated, we find that the average duration of life in thirteen small intestine ruptures (omitting the fourteenth case, which lived twenty-five days) amounted to fifty-two hours and forty-six minutes.

In the three cases of rupture of the large intestine, the average duration of life was eighty-eight hours, but one of the three cases accounted for two hundred and eighteen hours.

Consideration of these numbers seems to show that, on the whole, ruptures of the large intestine have a slightly better prognosis than those of the small; that the average duration of life is about the same whether large or small bowel is implicated, and that unsuccessful operative treatment does not materially shorten life.

As to the influence of the amount of time allowed to elapse before the performance of an operation, in the three successful cases this was six and one-half, eight, and twenty-six hours respectively, while the average time which elapsed in the whole fifteen amounted to eighteen hours, with extremes of three and twenty-six hours.

The points which affect the prognosis are, however, far more complicated than the mere time which elapses between the occurrence of rupture and the closure of the rent. First comes the actual extent of the local injury, and the possible coexistence of other visceral damage (in our cases, however,

all the intestinal injuries, except the one accompanied by a fracture of the frontal bone, which probably in no way affected the issue) were uncomplicated. Secondly comes the strength, age, and vitality of the patient, and, most important of all, the capacity possessed by the subject, both local and general, to resist the influence of the peritoneal septicæmia always resulting. Of this capacity we can form no exact notion, except by the comparative rapidity with which symptoms develop, and this may certainly give us some prognostic aid.

Speaking generally, it is clear that a small rent has a better prognosis than a large one, and that a rent of the small intestine is of greater import in some situations than one of the large. This for two reasons: First, the fluid contents of the small intestine more readily infects the peritoneum, and, moreover, in the most dangerous as the most movable area; secondly, because the contents of the large intestine often pass the opening without escaping, and when escape does occur, it is in a less dangerous peritoneal area, because less influenced by the intestinal movements, at any rate, when on the outer aspect of the bowel. Again, a retroperitoneal rupture may lead to the development of a local abscess, and the patient may escape the dangers of peritoneal septicæmia.

One case included in the table, that of rupture of the sigmoid flexure, gives some information as to the possible favorable prognosis in injuries to the colon, and in further illustration of it, I will shortly relate the second case of rupture of the colon on which this paper is founded.

A man, aged twenty-four, was caught between two railway wagons and forcibly turned round and round between them until they came to a stand-still. When released he dropped to the ground, and was brought to the hospital. Superficial contusions only were noted, and, as there were no symptoms pointing to grave injury, he was allowed to return to his home. He was kept in bed by his medical attendant, as he complained of much pain, but there was no sickness or any other sign indicating injury to the intestinal tract. Meanwhile his appearance suggested some

internal mischief, and he had a raised temperature, the thermometer registering an average of 100° F. each evening. He was kept in bed twenty-five days, and then allowed to get up, but this was followed by a severe attack of pain in the right side of the abdomen, and the passage of urine containing a considerable amount of blood. The man was now confined to his bed for a further eight days, during which time he became worse, but the bowels continued to act, there was no sickness, and no more blood was passed with the urine. A tumor began to form in the right half of the abdomen.

On the thirty-fourth day he was admitted into the hospital, when his condition was as follows: There is some emaciation, which has been increasing, the face is thin and flushed, and the patient lies in the supine position with the knees drawn up. A large, tense, ill-defined swelling occupies the right half of the abdomen, extending from just below the costal margin to Poupart's ligament. It is dull on percussion, but the dulness does not extend into the right flank, and there is distinct fluctuation in the lower part of it. The evening temperature is 100° F. The urine contains a trace of albumen, but no blood.

On the thirty-seventh day an anæsthetic was given, and an incision made in the lower part of the tumor in the linea semilunaris; the abdominal wall was rigid and infiltrated, but no pus was met with until the peritoneal cavity was opened. A large, irregular cavity walled in by intestine was found, containing dirty-colored pus, fæcal in odor, but containing no distinct fæcal lumps. The ascending colon formed the outer limit, and was firmly adherent to the abdominal wall. The cavity was flushed with hot sterilized water, and a drainage-tube inserted, the upper part of the wound being closed with sutures.

When the wound was dressed the next day, there was a considerable amount of discharge of fæcal odor, and on each of the following three days there was abundant discharge and obvious fæcal matter in small quantities. After this date the discharge lessened in quantity, became gradually less offensive, and no fæces were again seen. The sinus was firmly closed at the end of a month, when the patient left the hospital well, and shortly resumed his occupation.

I think it is evident, from the history and course of this

case, that the original injury of the colon could not have amounted to actual perforation, but rather to such severe contusion that sloughing subsequently took place. Another point of interest lies in the question as to whether the perforation, when it did occur, was intraperitoneal, and safeguarded by such slight peritoneal adhesions that the mere act of getting up caused them to give way; or whether the act of getting up caused a collection of pus in the retroperitoneal space on the surface of the kidney to make its way into the peritoneal cavity. The attack of hæmaturia seems to point to concomitant injury to the kidney, and probably both injuries must have been in the same region. The absence of any palpable swelling in the loin, where an abscess usually forms subsequently to a retroperitoneal rupture seems in favor of the intraperitoneal theory.

Consideration of the history of the case of rupture of the sigmoid flexure, quoted in the table, is also an argument in favor of the intraperitoneal nature of the injury, since, in that instance, an actual perforation was found, and yet no escape of fecal matter sufficient to give rise to serious signs of septic poisoning took place until after the administration of an enema. It is, moreover, a well-known fact that small punctures of the colon are by no means always followed by the escape of feces.

Treatment.—The general line of treatment in these injuries is sufficiently set forth in the account of the case forming the preamble of this paper. In the earlier cases included in the tables complete circular resection of the lumen of the bowel was practised, with end-to-end junction, but in the later ones simple suture of the rent sufficed to fulfil all the indications, the union obtained proving uniformly competent even in those ending fatally.

Resection should, therefore, be reserved for those cases only in which actual transverse solution of the continuity of the bowel has occurred, or those in which a segment is irretrievably damaged by contusion or laceration.

Choice of Moment for Operation.—Speaking generally,

this cannot be too early, if the injury is either diagnosed or suspected; none the less, it may be necessary to await reaction from the primary shock, due either to idiosyncrasy, the severity of the injury, or occasionally to the amount of hæmorrhage.

From whatever cause due, it may be necessary to combat shock by the application of hot bottles, the administration of stimulants (preferably per rectum), the hypodermic injection of strychnine, and, in severe instances, by the infusion of normal saline solution. The need of care in the exhibition of stimulants when hæmorrhage is suspected is obvious.

Selection of Site for Exploratory Incision.—Bearing in mind the usual location of ruptures, a median incision between the umbilicus and the pubes, in or slightly to one or other side of the linea alba, is generally to be preferred for the following reasons: (1) It will not be far removed from the seat of injury; (2) it may avoid the bruised portion of the abdominal parietes; (3) it can be readily extended, and it permits of the most satisfactory subsequent cleansing of the peritoneum.

Indications of the Site of Rupture.—An early localization of this is important, as preventing diffusion of septic matter, which is necessarily the result of lengthy exploration of the abdomen. Preliminary indications are found in the history and possibly in the presence of a local abrasion or bruise. When the belly is opened the following points may be borne in mind:

(a) The discovery of intestinal contents. As already remarked, the escape of chyme or fæces is usually not abundant, and may only be helpful in connection with the points dealt with under the following two headings, and as possessing a characteristic odor.

(b) The presence of plastic lymph. This is developed early, and especially in the neighborhood of the rent. The importance of *b*, *c*, and *d* in the production of certain physical signs has already been dwelt on.

(c) The presence of local peritoneal effusion, often in some quantity, and foul smelling; in the early stages this is also confined to the region of the injury, and is the result of the peritoneal infection.

(d) The presence of blood in small quantity, usually coagulated and in close relationship to the lesion.

(e) The escape of intestinal gases.

(f) The presence of retroperitoneal emphysema, pointing to injury to the colon or duodenum outside the limits of their peritoneal covering.

(g) The possible presence of ecchymoses of the parietal or visceral peritoneum.

Method of Suture.—In all moderate rents, unaccompanied by severe surrounding contusion, simple suture of the opening by Lembert's method is to be preferred.

When surrounding contusion is severe, or complete transverse solution has occurred, resection of a suitable portion of the gut should be followed by closure of the ends of the cut bowel, and the establishment of a lateral union or anastomosis, with Halsted's method of suture. This method is to be preferred by reason of the better results experienced after its use, and the far more satisfactory blood-supply obtained for the line of suture by it. Its only disadvantage is in the question of time, and should the condition of the patient be such as to preclude its use, a Murphy's button or some such mechanical method may be substituted.

Cleansing of the Peritoneum.—The suture completed, the next step is the cleansing of the belly cavity. This is best effected by preliminary dry sponging of the obviously infected area, followed by irrigation, and, if necessary, the protrusion and washing of the small intestine and thorough flushing of the pelvis and various peritoneal fossæ. Irrigation prior to the dry cleansing of the most severely affected area is to be avoided as tending to diffuse septic material.

Drainage.—This is to be avoided, if possible, but if, from the extent of the infection or the special distribution of it, drainage is necessary, a fairly wide gap in the external wound,

and a gauze plug leading down to the region needed, is the most satisfactory method to employ.

After-Treatment.—Shock may need to be met in the same way already indicated in speaking of the primary condition, and it is here, perhaps, that saline infusions are most useful: if necessary, a small amount of alcohol may be added to the saline solution.

Warm water may be allowed by mouth from the time of complete recovery from the anæsthetic; rectal feeding should be relied on for the first twenty-four hours, after this period (in the absence of vomiting) fluid nourishment may be administered by the mouth with safety and advantage.

Morphine should be avoided if possible.

Should distention and sickness herald the advent of septic infection, saline purgation should at once be resorted to as in other cases of peritoneal septicæmia. Sulphate of magnesia may sometimes be retained, even when vomiting is troublesome, by washing out the stomach preliminary to administering each dose. If the suture has been effectively accomplished, I believe there is no fear to be entertained from the administration of a saline purge, while enemata are practically useless in cases of peritoneal septicæmia, and a real danger in cases of injury to the large gut, from the amount of mechanical disturbance of the parts which they produce.

ANALYSES OF CASES OF RUPTURE OF THE INTESTINE TREATED IN ST. THOMAS'S HOSPITAL.

TABLE I.—HISTORY AND NATURE OF INJURY.

CASE I.—*Year, 1889. Reference, J. Croft, Clinical Society's Transactions, Vol. xxiii, p. 141. Male, aged fourteen years. Nature of violence, kick by horse. External signs of violence, none, but history located blow below umbilicus. Part of bowel affected, small intestine, ileum, point undetermined. Nature of injury to bowel, rupture of under surface, three-eighths inch in diameter; corresponding ecchymosed spot on opposite side of gut. Nature of fluid, etc., found in belly at operation, one and a half ounces turbid-brown fluid of fæcal odor. Operation, median abdominal section; resection and end-to-end junction. Result, cured.*

CASE II.—*Year*, 1889. Male, aged eight years. *Nature of violence*, fall of twelve feet onto anvil. *External signs of violence*, bruising midway between umbilicus and pubes. *Part of bowel affected*, ileum, eighteen inches from cæcum. *Nature of injury to bowel*, lacerated wound of free margin of gut. *Nature of fluid, etc., found in belly at operation*, no mention. *Operation*, median abdominal section; resection and end-to-end junction. *Result*, died.

CASE III.—*Year*, 1889. Male, aged two years. *Nature of violence*, run over. *External signs of violence*, bruise one-half inch broad on left side of belly, at level of umbilicus. *Part of bowel affected*, jejunum, four feet from pylorus. *Nature of injury to bowel*, complete transverse rupture. *Nature of fluid, etc., found in belly at operation*, no mention, but rupture not found; fæces at post-mortem. *Operation*, abdominal section; rent not discovered. *Result*, died.

CASE IV.—*Year*, 1890. *Reference*, St. Thomas's Hospital Reports, Vol. xxi, p. 428. Male, aged sixty-one years. *Nature of violence*, buffer accident. *Part of bowel affected*, ileum, ten feet ten inches from cæcum. *Nature of injury to bowel*, three-eighths inch longitudinal rent at free margin. *Nature of fluid, etc., found in belly at operation*, fæces in hernial sac. *Operation*, section and exploration of hernial sac. *Result*, died.

CASE V.—*Year*, 1890. *Reference*, St. Thomas's Hospital Reports, Vol. xxi, p. 428. Male, aged twenty-three years. *Nature of violence*, kick by horse. *External signs of violence*, bruise to left of umbilicus. *Part of bowel affected*, transverse colon. *Nature of injury to bowel*, three-fourths inch longitudinal rent; one inch area of ecchymosis and stripping of coats around. *Nature of fluid, etc., found in belly at operation*, dirty-red fætid fluid. *Operation*, abdominal section, suture of rent, and omental graft. *Result*, died.

CASE VI.—*Year*, 1892. *Reference*, St. Thomas's Hospital Reports, Vol. xxii, p. 273. Male, aged sixty-four years. *Nature of violence*, blow by falling box. *Part of bowel affected*, jejunum, sixteen inches from pylorus. *Nature of injury to bowel*, small linear rent; lacerated wound of omentum. *Operation*, none. *Result*, died.

CASE VII.—*Year*, 1892. *Reference*, St. Thomas's Hospital Reports, Vol. xxii, p. 273. Male, aged twenty-four years. *Nature of violence*, kick by a horse. *External signs of violence*, median bruise below umbilicus. *Part of bowel affected*, jejunum, in two places, twenty and thirty inches from pylorus. *Nature of injury to bowel*, two complete transverse ruptures three inches apart; a third one foot lower. *Nature of fluid, etc., found in belly at operation*, much blood; second operation, fæces from hole due to ulceration of suture. *Operation*, abdominal section, one end-to-end, and one lateral junction with Senn's plates. *Result*, died.

CASE VIII.—*Year*, 1894. *Reference*, St. Thomas's Hospital Reports, Vol. xxiii, p. 355. Male, aged sixty years. *Nature of violence*, fall from van. *Part of bowel affected*, sigmoid flexure. *Nature of injury to bowel*, minute hole, allowing passage of fluid. *Operation*, none. *Result*, died on sixth day.

CASE IX.—*Year*, 1895. *Reference*, St. Thomas's Hospital Reports,

Vol. xxiv, p. 373. Male, aged fifty-seven years. *Nature of violence*, run over by cart. *External signs of violence*, bruising in left inguinal region. *Part of bowel affected*, ileum, eleven feet from pylorus. *Nature of injury to bowel*, ragged longitudinal rupture at free margin. *Nature of fluid, etc., found in belly at operation*, no mention. *Operation*, abdominal section; suture of rent. *Result*, died.

CASE X.—*Year*, 1895. *Reference*, St. Thomas's Hospital Reports, Vol. xxiv, p. 373. Male, aged twelve years. *Nature of violence*, run over by cart. *Part of bowel affected*, ileum, three feet eight inches from cæcum. *Nature of injury to bowel*, transverse rupture with clean edges of one-half inch circumference. *Nature of fluid, etc., found in belly at operation*, blood. *Operation*, abdominal section; resection and end-to-end junction. *Result*, died.

CASE XI.—*Year*, 1896. *Reference*, St. Thomas's Hospital Reports, Vol. xxv, p. 369. Male, aged thirty-eight years. *Nature of violence*, kick by horse. *External signs of violence*, no bruise; tender spot just within anterior superior spine of ilium. *Part of bowel affected*, ileo-jejunal junction(?). *Nature of injury to bowel*, transverse rent, starting from mesenteric border and involving one-third of its circumference. *Nature of fluid, etc., found in belly at operation*, sero-purulent fluid. *Operation*, abdominal section; suture. *Result*, died.

CASE XII.—*Year*, 1897. *Reference*, St. Thomas's Hospital Reports, Vol. xxvi, p. 365. Male, fifty-two years. *Nature of violence*, fall with man across his belly. *Part of bowel affected*, ileum, nine inches from cæcum. *Nature of injury to bowel*, two small rents. *Nature of fluid, etc., found in belly at operation*, faecal matter. *Operation*, abdominal section; suture. *Result*, died.

CASE XIII.—*Year*, 1897. *Reference*, St. Thomas's Hospital Reports, Vol. xxvi, p. 366. Male, aged forty-nine years. *Nature of violence*, pinned against wall by van pole. *External signs of violence*, local tenderness in right iliac fossa, part struck. *Part of bowel affected*, jejunum, six feet two inches from pylorus. *Nature of injury to bowel*, rent at free margin one-half inch long. *Operation*, none. *Result*, died.

CASE XIV.—*Year*, 1897. *Reference*, St. Thomas's Hospital Reports, Vol. xxvi, pp. 100, 366. Male, aged nineteen years. *Nature of violence*, run over by van. *External signs of violence*, emphysema, right flank. *Part of bowel affected*, duodenum, second part, retroperitoneal two and a half inches from pylorus. *Nature of injury to bowel*, rent one-half inch long. *Nature of fluid, etc., found in belly at operation*, blood; free gas. *Operation*, abdominal exploration. *Result*, died.

CASE XV.—*Year*, 1898. *Reference*, St. Thomas's Hospital Reports, Vol. xxvii; see also B. Pitts, Vol. xxvi, p. 93, full account. Male, aged thirty-seven years. *Nature of violence*, kick by horse. *External signs of violence*, local tenderness equal to area of palm of hand above pubes. *Part of bowel affected*, small intestine. *Nature of injury to bowel*, perforation at free border of gut; hole in mesentery admitting little finger. *Nature of fluid, etc., found in belly at operation*, no free fluid; fragments of undigested food. *Operation*, abdominal section; suture. *Result*, cured.

CASE XVI.—*Year*, 1898. *Reference*, St. Thomas's Hospital Reports, Vol. xxvii. Male, aged twenty-six years. *Nature of violence*, blow from end of log on sawing machine. *External signs of violence*, graze and abrasion just above and within anterior superior spine of ilium. *Part of bowel affected*, junction of cæcum and ascending colon. *Nature of injury to bowel*, two rents, one of peritoneal coat only, one perforating. *Nature of fluid, etc.*, found in belly at operation, muddy-brown, fæcal-smelling fluid and blood-clot. *Operation*, abdominal section; suture. *Result*, cured.

CASE XVII.—*Year*, 1898. *Reference*, St. Thomas's Hospital Reports, Vol. xxvii. Male, aged sixty-two years. *Nature of violence*, kick by horse. *Part of bowel affected*, transverse colon. *Nature of injury to bowel*, most prominent part of U-loop bruised and small rent near mesenteric border. *Operation*, none. *Result*, died.

CASE XVIII.—*Year*, 1898. *Reference*, St. Thomas's Hospital Reports, Vol. xxvii. Male, aged forty-one years. *Nature of violence*, buffer accident. *External signs of violence*, abrasion in right iliac region. *Part of bowel affected*, ileum. *Nature of injury to bowel*, rent equal to a contused hole the size of a threepenny piece. *Nature of fluid, etc.*, found in belly at operation, blood and a small quantity of fæces post-mortem. *Operation*, none. *Result*, died.

CASE XIX.—*Year*, 1898. *Reference*, St. Thomas's Hospital Reports, Vol. xxvii. Male, aged seven years. *Nature of violence*, fall from window, eight feet, across iron railing. *External signs of violence*, bruise across belly at level of anterior superior spines. *Part of bowel affected*, ileum, six inches from cæcum. *Nature of injury to bowel*, rent admitting finger-tip at free border. *Nature of fluid, etc.*, found in belly at operation, one ounce fæces and sero-purulent fluid in pelvis. *Operation*, abdominal section; suture. *Result*, died.

CASE XX.—*Year*, 1898. *Reference*, W. H. Battle, *Lancet*, December, 1898, Vol. ii. p. 1548. Male, aged twenty-seven years. *Nature of violence*, run over. *External signs of violence*, abrasions below umbilicus. *Part of bowel affected*, ileum, twelve inches from cæcum. *Nature of injury to bowel*, rent three-eighths of an inch long. *Nature of fluid, etc.*, found in belly at operation, semipurulent fluid. *Operation*, abdominal section; suture; wound of abdominal parietes gave way on tenth day. *Result*, died on twenty-fifth day.

CASE XXI.—*Year*, 1895. *Reference*, G. H. Makins, St. Thomas's Hospital Reports, 1895, Vol. xxiv, p. 92. Male, aged twenty-four years. *Nature of violence*, caught between passing trucks. *Part of bowel affected*, ascending colon. *Nature of injury to bowel(?)*, severe contusion only, and secondary sloughing. *Nature of fluid, etc.*, found in belly at operation, fæces from fistula after operation; pus with fæcal odor from abscess. *Operation*, secondary opening of abscess followed by fæcal fistula. *Result*, cured.

TABLE II.—SYMPTOMS AND DURATION OF LIFE.

CASE I.—*Part of bowel, ileum.* Male, aged fourteen years. *Shock*, slight; unconscious for a time. *Abdominal pain*, not marked till twenty-four hours after accident. *Vomiting*, vomited three times after medicine; no further sickness when food was stopped; whitish fluid. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, none. *Physical signs on palpation and percussion*, tenderness below umbilicus; dullness in left flank. *Time between occurrence of accident and operation*, twenty-six hours. *Duration of life after operation*, cure. *Duration of life after injury*, cure.

CASE II.—*Part of bowel, ileum.* Male, aged eight years. *Time between occurrence of accident and admission*, two hours. *Shock*, marked; temperature, 97.8° F. *Abdominal pain*, marked on admission. *Vomiting*, commenced one hour after accident and continued up to time of operation; dirty-brown fluid. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, ten hours after accident. *Physical signs on palpation and percussion*, circular patch of dullness, three inches in diameter, to right of median line below umbilicus, here very tender. *Time between occurrence of accident and operation*, twenty-four hours. *Duration of life after operation*, seventeen hours. *Duration of life after injury*, forty-one hours. *Remarks*, wished to defecate immediately after accident.

CASE III.—*Part of bowel, jejunum.* Male, aged two years. *Shock*, collapse; temperature, 97.4° F.; pulse, 140. *Abdominal pain*, pain on decrease of shock. *Vomiting*, occasional before operation. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, on admission. *Physical signs on palpation and percussion*, local dull area below and to left of umbilicus; tenderness of left side of belly. *Time between occurrence of accident and operation*, seven hours. *Duration of life after operation*, fifteen hours. *Duration of life after injury*, twenty-two hours.

CASE IV.—*Part of bowel, ileum.* Male, aged sixty-one years. *Shock*, slight. *Vomiting*, commenced at the end of twenty-four hours. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, no mention. *Physical signs on palpation and percussion*, great tenderness of hernial sac. *Duration of life after injury*, twenty-eight hours.

CASE V.—*Part of bowel, transverse colon.* Male, aged twenty-three years. *Time between occurrence of accident and admission*, two hours. *Shock*, collapse. *Vomiting*, twice during the six hours prior to operation. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, no mention. *Physical signs on palpation and percussion*, great tenderness. *Time between occurrence of accident and operation*, six hours. *Duration of life after operation*, eighteen hours. *Duration of life after injury*, twenty-four hours.

CASE VI.—*Part of bowel, jejunum.* Male, aged sixty-four years. *Shock*, slight. *Vomiting*, slight. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, none. *Time between occurrence of accident and operation*, six hours. *Duration of life after injury*, thirty hours.

CASE VII.—*Part of bowel, jejunum.* Male, aged twenty-four years. *Shock*, collapse. *Vomiting*, vomited food soon after admission. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, on admission. *Physical signs on palpation and percussion*, tender; dull except below ensiform cartilage and in left flank. *Time between occurrence of accident and operation*, seven hours. *Duration of life after operation*, five days and seventeen hours. *Duration of life after injury*, six days.

CASE VIII.—*Part of bowel, sigmoid colon.* Male, aged sixty years. *Time between occurrence of accident and admission*, five days. *Vomiting*, frequent before admission. *Rigidity and immobility of abdominal wall*, rigidity marked. *Distention*, on admission, on fifth day. *Physical signs on palpation and percussion*, tender; distention in right iliac region. *Duration of life after injury*, nine days.

CASE IX.—*Part of bowel, ileum.* Male, aged fifty-seven years. *Shock*, slight. *Abdominal pain*, slight on admission. *Vomiting*, vomited contents of stomach eighteen hours after admission. *Rigidity and immobility of abdominal wall*, belly flaccid until eighteen hours after injury. *Distention*, eighteen hours after accident. *Physical signs on palpation and percussion*, fixed dullness in left flank; tenderness in left inguinal region. *Time between occurrence of accident and operation*, twenty hours. *Duration of life after operation*, four hours. *Duration of life after injury*, twenty-four hours.

CASE X.—*Part of bowel, ileum.* Male, aged twelve years. *Time between occurrence of accident and admission*, twenty-four hours. *Shock*, slight. *Abdominal pain*, little pain for first twenty-four hours. *Vomiting*, none during first twenty-four hours, then frequent. *Rigidity and immobility of abdominal wall*, no note; admitted second day. *Distention*, no mention. *Physical signs on palpation and percussion*, no dullness. *Time between occurrence of accident and operation*, twenty-four hours. *Duration of life after operation*, thirty-six hours. *Duration of life after injury*, sixty hours.

CASE XI.—*Part of bowel, small intestine.* Male, aged thirty-eight years. *Time between occurrence of accident and admission*, two hours. *Shock*, unconscious at first; little shock on admission. *Abdominal pain*, little pain. *Vomiting*, constant and immediate, soon becoming faecal. *Rigidity and immobility of abdominal wall*, no note. *Distention*, no mention. *Physical signs on palpation and percussion*, impairment of resonance in left flank; tender just within right anterior superior spine. *Time between occurrence of accident and operation*, five hours. *Duration of life after operation*, twenty hours. *Duration of life after injury*, twenty-five hours.

CASE XII.—*Part of bowel, ileum.* Male, aged fifty-two years. *Time between occurrence of accident and admission*, three days. *Abdominal pain*, pain. *Vomiting*, commenced after twenty-four hours, then constant until operation. *Rigidity and immobility of abdominal wall*, rigidity marked on third day, when admitted. *Distention*, on admission, on third day. *Physical signs on palpation and percussion*, tender; no dullness third day. *Time between occurrence of accident and operation*, third day.

Duration of life after operation, forty-eight hours. Duration of life after injury, five days.

CASE XIII.—*Part of bowel, jejunum. Male, aged forty-nine years. Time between occurrence of accident and admission, three days. Shock, little. Abdominal pain, pain on admission ceased, to commence again on third day. Vomiting, once after accident, again on third day, and on fourth day constant till death. Rigidity and immobility of abdominal wall, rigidity. Distention, on fourth day. Physical signs on palpation and percussion, dullness and tenderness in left iliac fossa. Duration of life after injury, fourth day.*

CASE XIV.—*Part of bowel, duodenum. Male, aged nineteen years. Time between occurrence of accident and admission, two hours. Shock, severe. Abdominal pain, severe. Vomiting, none. Rigidity and immobility of abdominal wall, no note. Distention, on admission. Physical signs on palpation and percussion, emphysema of flank and scrotum; absence of liver dullness. Time between occurrence of accident and operation, three hours. Duration of life after operation, nine hours. Duration of life after injury, twelve hours.*

CASE XV.—*Part of bowel, small intestine. Male, aged thirty-seven years. Time between occurrence of accident and admission, forty-five minutes. Shock, none. Abdominal pain, considerable on admission. Vomiting, immediate, bile-stained fluid; once after operation. Rigidity and immobility of abdominal wall, rigidity marked. Distention, no mention. Physical signs on palpation and percussion, tender above pubes and in left iliac fossa; tender area dull. Time between occurrence of accident and operation, six hours. Duration of life after operation, cure. Duration of life after injury, cure.*

CASE XVI.—*Part of bowel, junction of cæcum and colon. Male, aged twenty-six years. Time between occurrence of accident and admission, forty-five minutes. Shock, severe. Abdominal pain, moderate pain. Vomiting, immediate and frequent until operation. Rigidity and immobility of abdominal wall, rigidity marked. Distention, slight. Time between occurrence of accident and operation, eight hours. Duration of life after operation, cure. Duration of life after injury, cure.*

CASE XVII.—*Part of bowel, transverse colon. Male, aged sixty-two years. Time between occurrence of accident and admission, two hours. Shock, severe. Abdominal pain, severe pain. Vomiting, none. Rigidity and immobility of abdominal wall, respiratory movements good. Distention, none. Physical signs on palpation and percussion, neither local dullness nor tenderness. Duration of life after injury, less than twenty-four hours.*

CASE XVIII.—*Part of bowel, ileum. Male, aged forty-one years. Time between occurrence of accident and admission, two hours. Shock, none. Abdominal pain, pain in lower abdomen. Vomiting, nausea but no vomiting. Rigidity and immobility of abdominal wall, respiratory movements good. Distention, none. Physical signs on palpation and percussion, tenderness at site of abrasion; no dullness. Duration of life after injury, forty-eight hours.*

CASE XIX.—*Part of bowel, ileum. Male, aged seven years. Time between occurrence of accident and admission, four hours. Shock, slight; pulse, 120; temperature, 97° F. Abdominal pain, slight pain. Vomiting, retched, but no vomiting until end of twenty-four hours. Rigidity and immobility of abdominal wall, rigidity not present till seven hours after accident. Distention, none. Physical signs on palpation and percussion, no local tenderness or dullness. Time between occurrence of accident and operation, twenty-six hours. Duration of life after operation, ten hours. Duration of life after injury, thirty-six hours.*

CASE XX.—*Part of bowel, ileum. Male, aged twenty-seven years. Time between occurrence of accident and admission, two hours. Shock, drunk. Abdominal pain, not marked. Vomiting, commenced soon after accident, and continued three days after operation. Rigidity and immobility of abdominal wall, rigidity marked. Distention, none. Physical signs on palpation and percussion, tenderness; no dullness. Time between occurrence of accident and operation, twenty hours. Duration of life after operation, twenty-four days. Duration of life after injury, twenty-five days.*

THE PRINCIPLES OF THE TREATMENT OF INJURIES OF THE SPINAL CORD.¹

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DURING the past few years a considerable number of cases of injury of the spine, involving the cord, presenting a wide variety of lesions, have come under the observation of Dr. Pearce Bailey and myself, and the question of treatment by operative or non-operative methods has often come up for decision.

The literature of the subject is not at all satisfactory, since the problem is considered sometimes from the viewpoint of the spinal injury alone, sometimes from that of the cord lesion only, and thus conclusions diametrically opposed are encountered.

It is manifestly improper to subordinate either factor in the problem to be solved, and to treat the composite injury exclusively as one of the spinal bones or joints or as one of the cord; the display of judgment occurs in estimating the relative values of the two lesions present.

There can be no question that, so far as the spinal injury itself is concerned, the rules governing the treatment of fractures, dislocations, and distortions hold perfectly good within the limitations imposed by the anatomy of the spine, and that from this point of view there can be no reasonable objection to reduction by operative measures, if need be. So that this part of the problem may be dismissed without further discussion.

¹ Read before the New York Surgical Society, March 22, 1899.

The cord injuries, however, occur in such variety, their natural history is so imperfectly known, and their symptomatology oftentimes so puzzling that confusion in the identification of the lesion present has sometimes led to the adoption of methods of treatment whose results have been most misleading, and has caused operative or non-operative measures to be unjustly condemned or extolled.

It is interesting, therefore, to view the various forms of injury to which the cord is at present believed to be liable, to trace their natural history, and to conclude, if possible, to what extent their courses may be modified by treatment.

Many observers have studied the processes of repair of injuries of the cord in many classes of vertebrates, and while there is complete regeneration after division in some of the lower orders, in mammals there is practically none.

Indeed, in the immediate neighborhood of the lesion degenerative changes occur in the ganglion-cells and fibres cut off from their trophic centres, while in those in which the connection is preserved there is a feeble and never completed attempt at regeneration only.

The lesion is repaired by the growth of ordinary cicatricial tissue from the connective-tissue cells of the blood-vessels and the pia mater.

With this positive statement in mind the subsequent history of most of the cord lesions becomes intelligible.

(a) *Extramedullary hæmorrhage* (hæmatorrhaxis) occurs oftenest between the dura and the wall of the spinal canal, far less often within the dura. It is usual to find a moderate amount of blood infiltrating the epidural connective tissue at autopsies, done after severe injuries of the spine, in which vertebræ have been fractured or dislocated; but the amount of blood is commonly very moderate, the clot, so called, is seldom more than one-sixteenth inch in thickness, and rarely extends up and down for more than two or three inches.

A few cases have been recorded in which the whole epidural tissue has been infiltrated by blood.

Within, in the dura, and outside of the cord blood is

rarely found, except as it finds its way, from without in small amounts, through rents in the dura.

Whether hæmorrhage between the dura and bone ever occurs in sufficient volume to give rise to symptoms referable to the cord by causing compression of it is yet to be proved.

No such case is recorded, so far as we have been able to learn.

Certain it is that, in the *autopsies* made by us, along with the extradural hæmorrhage, there has been invariably some demonstrable lesion of the cord itself.

Indeed, it is difficult to understand how the cord itself could be compressed at all, much less severely, by bleeding into the epidural tissue, when one considers that the bleeding occurs chiefly from veins of small size, the wide distribution possible for the blood before the available space is occupied and compression mechanically possible.

We are aware that extradural hæmorrhage has been assumed to be the cause of the symptoms grouped under the title "diplegia brachialis," but the conclusion is based upon theoretical grounds, and the logic by which it is reached is no more convincing than that which may be adduced to show that the symptoms are due to intramedullary hæmorrhages or to injury of the nerve-roots in the foramina.

(b) *Injuries of the Cord Itself*.—These have been grouped according as they do or do not consist in entire crushing or division or laceration of the cord, as (1) complete lesions and (2) incomplete lesions.

(1) Complete lesions occur most commonly in fractures and dislocations of the vertebræ, the result of forced flexion of the spine, in which the affected portion of the cord is crushed against the body of the lower vertebra by the arch of that above or by fragments of vertebræ or intervertebral disks displaced into the canal.

A similar result may be produced by a direct or indirect fracture of the laminæ of a single vertebra with depression of the fragment into the spinal canal upon the cord.

In any case, the cord is pulped within the pia, when

the gross appearance of the cord may be little if at all changed, or the pia is also torn; in longitudinal extent the lesion usually is confined to about one inch, more or less.

On section of this region the cord is found to be softened, the outlines of the gray matter are indistinct or lost, and not infrequently extending from the site of the contusion there is hæmorrhage into the gray matter.

Disintegration of the cells and fibres in the affected area immediately follows, and the lesion in the end is repaired by the growth of ordinary cicatricial tissue without any regeneration of nerve elements; the few nerve-fibres found in such cicatrices are supposed to be persisting and originally uninjured fibres.

It is conceivable that wounds of the spine involving the cord might result in complete division, but, in fact, in the vast majority of instances, the cord is only partially divided.

Large numbers of experiments have been made, however, to study the effects of clean-cut, total divisions of the cord, and the results have shown repair to be by cicatricial tissue also and without regeneration.

(2) Incomplete lesions of the cord occur at times under the same conditions as those just enumerated as accompanied by complete lesions, but are most often found along with stab- or bullet-wounds or distortions of the spine.

The lesions produced fall into either of two fairly marked classes:

(a) In which there is division or destruction of fibres and cells by agencies acting from without, and (b) in which nearly the same effect is produced by hæmorrhage within the cord itself.

In the first class are found the wounds of the cord. Here a foreign body, generally a knife-blade or bullet, is driven forcibly through, rarely between the spinal bones, sometimes splintering them, enters the spinal canal, first, probably, depresses the dura upon the cord, contusing the latter, then divides the dura by tearing through it, and finally produces a clean-cut or more often a contused wound of the cord.

Bony spicules, resulting from comminution of the spinal bones in open or subcutaneous injuries, may readily produce lesions of the cord identical anatomically with those of stab- and bullet-wounds.

In any case, the body foreign to the cord may remain *in situ* or be displaced.

The injury thus produced in the cord is in lesser degree the same as that in complete lesion; there is direct destruction of cells and fibres and hæmorrhage into the affected segment. Degeneration occurs above and below and also beyond the lesion at its level.

Repair occurs, as before, through the growth of scar tissue; the directly injured cells and fibres are lost, but regeneration of at least some of the momentarily compressed and consequently incompletely degenerated fibres beyond the limits of the original lesion may occur, and as the disturbed blood and lymph circulations here are restored there is a corresponding revival of the function of the neighboring elements.

The presence or absence of infection plays the usual *rôle* in the healing of cord wounds, and implies a minimum loss of nerve elements and minimum scar or great loss and large scar.

(b) In the second class of incomplete lesions of the cord occur hæmorrhages into its substance, with more or less destruction of cells and fibres, hæmatomyelia in distinction to hæmatorrhaxis.

Such hæmorrhages, while occasionally occurring in the white columns of the cord only, as a rule occur in the gray matter, and spread for variable distances, remaining confined almost entirely to the gray columns, and involving the white matter slightly, if at all.

Their site is commonly, but not exclusively, at the cervico-dorsal or dorso-lumbar junction, in those portions of the cord corresponding to the most freely movable parts of the spine; and this fact points to their probable etiology by over-tension in the long axis of the cord.

Along with hæmatomyelia there may be, and not infrequently is, more or less contusion of the cord.

The cells and fibres of the gray matter into which the hæmorrhage occurs are at once destroyed; the increase in intramedullary pressure, through the presence of the extravasated blood, disturbs, to a greater or less degree, the lymphatic and blood circulation of the rest of the cord at the same level, and may be sufficient to produce degeneration and death of cells and fibres in this region not otherwise directly involved, but in many cases their function first suspended is subsequently regained, particularly when the extravasation is in small or moderate amount.

As the extravasated blood is absorbed, cavities may persist, described under the name of hæmatomyelapore, or more often there is proliferation of the neuroglia which replaces the clot.

These are the lesions to one or another of which the cord is at present believed to be liable in injuries of the spine in which it is involved.

It now remains to consider them from the view-point of their remedialness by any means.

Preliminary to this it ought to be repeated that cells and fibres of the cord are readily destroyed, and once destroyed are never regenerated.

Thus it appears that—

(1) Extradural hæmorrhage does not give rise to cord lesions or symptoms, and requires no treatment.

(2) Total lesions of the cord are irremediable, because the cells and fibres of the entire thickness of the cord are destroyed, are never regenerated, and are replaced by cicatricial tissue. The lesion thus is permanent and requires no treatment.

(3) In hæmatomyelia the clot is absorbed; its site persists as a cavity or is filled by newly formed tissue; irregularities of circulation in the surrounding portions of the cord adjust themselves. There may be great amelioration of the symptoms.

There is therefore no therapeutic indication, and no remedial treatment is possible.

(4) In partial contusion of the cord the lesion results in permanent destruction of cells and fibres; disturbances of circulation adjust themselves. Repair is accomplished by cicatricial tissue. No treatment is available.

(5) In open injuries of the cord there are destruction of cells and fibres and disturbances of circulation. In addition, infection may occur or a foreign body be introduced and left in or lodged against the cord, and by its continued presence produce great disturbance of circulation and consequent extensive degeneration and necrosis of cells and fibres. Repair occurs by cicatricial tissue as before.

But here active operative interference is indicated to remove foreign bodies, to facilitate disinfection, to prevent more extensive necrosis, and to facilitate drainage.

OBSERVATIONS ON THE DETECTION OF SMALL
RENAL CALCULI BY THE RÖNTGEN
RAYS.¹

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It is my intention, in this paper, merely to state what has been and is likely to be obtained from the X-rays in discovering renal calculi.

It would be remarkable, indeed, if this wonderful looking-into-darkness did not yield, in time, something to aid the surgeon and physician in adding to his clinical observation a method of precision, which even the most astute observer must sometimes desire.

Before the use of X-rays the only symptoms which were of practical moment in discovering renal calculi were nephralgia and hæmaturia, and by these a good clinician has usually been able to say, "Here is probably a renal calculus."

The cases in which it is possible to palpate the stone through the abdominal wall must be rare, indeed, though such have been recorded where extraordinarily large stones exist.

The previous passage of small stones by a patient may be a strong argument that another one is in the kidney, where symptoms point that way; yet the majority of cases where serious symptoms occur have solitary and, usually, immovable stones, rarely large.

Doubt about the existence of a stone can be settled in

¹ Read before the New York Surgical Society, April, 1899

only two ways,—by exploratory nephrotomy and radiography.

The former operation is, to-day, one of such precision that it may be viewed with no anxiety, when well conducted.

Every surgeon, however, will recall cases (of probable stone) where his exploratory nephrotomy did not discover any. Henry Morris, in his admirable Hunterian Lectures, last year, recorded forty-four cases in which he had failed to find the stone he looked for; these he called "negative exploration," and usually some other cause for the symptoms was found, and the patient often relieved.

In many of these cases an undiscovered stone may have been present, failure to discover it being illustrated in the reports given below.

The following twenty-five cases are, I believe, all that are in print; there are doubtless many more yet unrecorded.

I have added two most interesting illustrations of my own, a total of twenty-seven, in which the operation verified the discovery of the stone by radiograph.

CASE I.—The credit of the first radiograph of a renal calculus in the body is due to Dr. MacIntyre, of Glasgow (*Lancet*, July 11, 1896). He obtained this with a six-inch spark and twelve minutes' exposure. The skiagram recorded the correct situation of an elongated deposit, which was removed by Adams, of Glasgow.

CASE II, September 3, 1896, was published by Dr. James Swain (*Bristol Chirurgical Society*, 1897). The patient, a spare man, presented typical symptoms. Skiagram showed a distinct shadow in region of left kidney. A ten-inch coil, exposure of thirty minutes. Nephrotomy was done, permitting extraction of a stone of oxalate of lime, 148 grains in weight, which was over an inch in length, by seven-eighths of an inch in thickness.

CASE III.—Görl (*Nuremberger medicinische Gazette und Zeitschrift und Polycline*, December 2, 1897) photographed stone the size of a plum; removed by operation.

CASE IV.—Carl Lowenstein (*Deutsche Zeitschrift für Chirurgie*, Vol 1, 1898, p. 195) reports a case of renal calculus removed after X-ray photography. Patient, male, forty-seven years of

age, thin and slender, when twenty years old, passed gravel at times. Fourteen months ago had a sharp renal colic, and passed three small stones. Since then no attack; but slight colic occurring every day.

Physical Examination.—Kidneys not palpable; region of right kidney painful on deep pressure; urine, specific gravity 1020, acid; some leucocytes and blood.

X-ray plate showed a stone two by three centimetres; four centimetres from the border of vertebral bodies, eight centimetres from the spinal processes, three centimetres from the border of the twelfth rib. The stone could not be felt, on operation, until the pelvis of the kidney was incised. Stone measured two and one-quarter by one and three-quarters by one centimetre; weight, eight grammes. Composed largely of calcium carbonate, with calcium oxalate and uric acid.

Kimmel (Congress of General Surgeons) mentions the fact of having found stones in the kidney after frequent failures (by X-ray).

CASE V.—E. Hurry Fenwick (*International Medical Annual*, 1898, p. 338) speaks of one case, with an accurate picture. Stone removed.

CASE VI.—Albert Alsberg (*Münchener medicinische Wochenschrift*, 1898, No. 51, p. 1637) speaks of a man, thirty-four years old, well nourished and of large frame, who had had pain for ten years in right kidney region, but no acute attacks of colic. Pain very severe just before admission. Nothing found on physical examination. Urine was clear, acid, no albumen or sugar. Microscopical examination negative. The X-ray showed a shadow four centimetres from the vertebral column, measuring three and one-half centimetres by two and one-quarter centimetres. One and one-half centimetres below this was a smaller shadow one centimetre in diameter.

Operation.—Large stone easily found; but some search was necessary for the second, which was found to be a conglomeration of small stones, each the size of a pea, embedded in one of the calyces and connected with the pelvis by a small opening. Kidney sutured. Primary union. The large stone corresponded quite exactly with the X-ray when laid on the plate. It was a very hard oxalate stone, three and one-half by two and one-quarter by one and one-half centimetres, had many sharp projections, and was dark brown. Weight, eight grammes (240 grains). The

smaller stones were also hard and brownish. Weighed together two grammes (sixty grains); also oxalate. Patient gave no symptoms but pain. Second stone would probably not have been found but for the X-ray.

The field of the X-ray was carefully *diaphragmed off* by lead plates. Interruptions were fifteen hundred per minute; tube, fifty centimetres from plate; twelve-centimetre spark; eight minutes' exposure.

CASE VII.—Fenwick (*British Medical Journal*, 1897, p. 1075) speaks of using a small fluoroscope, directly applied to kidney, after it has been freed and brought up into wound. In this way he has seen a stone of half an inch in diameter.

CASE VIII.—Fred. Taylor (*British Medical Journal*, 1898, p. 1136) reports a case of a patient from whom he removed a stone weighing half an ounce, size and shape of the distal segment of a small thumb, which was embedded in a cyst cavity, and had not been discovered by previous lumbar exploratory incision. In picture the stone presented lying above the level of the twelfth rib.

CASE IX.—Charles A. Morton (*Lancet*, June 4, 1898, p. 1354). The patient was admitted to the Bristol General Hospital with well-marked symptoms of renal calculus, and but for the skiagraph the boy would have been considered as cured by the passage of the stone. The picture showed a stone as lying over the twelfth rib, one and one-quarter inches from the spine. It was found, on operation, to lie in the upper and anterior part of the kidney, covered by a thin layer of renal tissue. The stone was oxalate, three-quarters inch by one-half inch in diameter.

CASE X.—Arthur W. Bevan (*Chicago Medical Record*, 1898, Vol. xiv, p. 197). Large stone, entirely filling the pelvis of the kidney, which gave no symptoms. Previously a stone had been removed from the other kidney.

CASE XI.—McArthur (*Chicago Medical Record*, 1898, Vol. xiv, p. 127) reports a case of supposed pyelitis, in which a stone had been previously removed from the other kidney. The stone was demonstrated by X-ray and removed. It was phosphatic and measured three-quarters inch by one-half inch.

CASE XII.—T. A. Thyne (*Australasia Medical Gazette*, 1897, p. 502) reports a patient with typical symptoms of calculus. The calculus was oval, weighed 275 grains; proved to be oxalate.

CASES XIII AND XIV.—Hans Wagner (*Centralblatt für Chirurgie*, No. 8, 1899), reports two cases, first, a ten-year-old girl, with fistula in left kidney, which secreted 100 cubic centimetres of urine by day. Fluid contained no urea, hence it was supposed that all kidney tissue had disappeared. Radiograph showed four stones, one large one, filling the entire pelvis, three small ones, the size of peas. Verified by operation.

Second case: A woman, thirty-eight years old, with septic pyonephrosis. Stone the size of a walnut; discovered by X-ray in the pelvis of the kidney. The patient died before the operation could be done, but its presence was verified by autopsy.

CASE XV.—Charles L. Leonard reports three cases. In one case, two calculi were discovered, and their relative size and position determined. The removal of the smaller uric acid calculus was entirely due to the data obtained from skiagraph. It was encysted in the inferior calyx and could not be detected by palpation of the kidney, and certainly would have escaped detection save for the radiograph. The calculus was quite small, not over the diameter of the rib.

Patient, C. W., age nineteen years (*Archives of Röntgen Rays*, May, 1898, p. 96), had clinical symptoms of renal or bladder lesion, but nothing definite. A skiagraph, twenty minutes' exposure, eight inches coil, was made.

CASE XVI.—In a second case, the calculus was found partially encysted in the upper calyx, after a search that was persisted in, because of the skiagraphic evidence.

CASE XVII.—Calculi were seen in both kidneys. (Leonard reports eight additional cases, without detail, in which he found stone.)

Barrie Blacker (*Centralblatt für Chirurgie*, 1898, p. 234), in discussion on the report of Taylor's case, said he had examined dozens of cases of supposed renal calculi, and in only three had the plate shown stone present. Grummach (Medical Congress of Moscow) showing photograph of renal calculi (*Münchener medicinische Ite*, 1897).

CASE XVIII.—McBurney reported to the Practitioners' Association, in 1898, the case of a young man presenting an X-ray view of a roundish stone, three-quarters inch in diameter, successfully removed.

Success in my own experience with radiography in con-

nection with renal calculi is limited to two cases. After photographing many suspects which afterwards proved to be non-calculous and of the type usually under suspicion, nephralgia, pyonephrosis, hydronephrosis, and tubercular kidney.

Up to July last I had supposed my failure due to the generally believed idea that to photograph a renal calculus was generally impracticable, but I now realize that it was only because no case of real calculus of the kidney had presented itself to me.

CASE XIX.—About the 1st of June, 1898, an Italian, of average build, twenty-seven years of age, presented himself at my office, complaining that he had had great pain in his side for many years, and a few days before had passed bloody urine, and as I was somewhat hurried, not caring to go into elaborate study of his case, I had him lie down, and took a fifteen minutes' exposure of the affected side, and dismissed him for a few days.

On developing the picture I was surprised to find an unmistakable shadow at the site of the kidney. As much care had been taken to develop the picture, and the man had been without clothing, the shadow could admit of but one interpretation.

On further inquiry into the patient's history, I found he had had pain in the region of the right kidney since he was twelve years old. He had several times passed blood, first thirteen years ago; second, nine years ago, and again four years ago; not again until eight days.

During the past five years he had been incapacitated with frequently recurring attacks, and during the last month had had pain every day. This pain was in the right lumbar region, in the right iliac region, and at the end of the penis. He had sought treatment at many hospitals and clinics in Italy, and here, without help.

On the 1st of June I operated at St. Luke's Hospital. After exposing the kidney by the high intermuscular incision, I raised it from its bed and brought it up into the wound. Palpation failed to detect any sense of hardness like stone. An incision through the greater curvature of the kidney admitted the finger into the pelvis, but found no stone there. After some minutes of searching with a metallic searcher, the grating of a calculus could be felt, but not located. At one time it would be felt only when

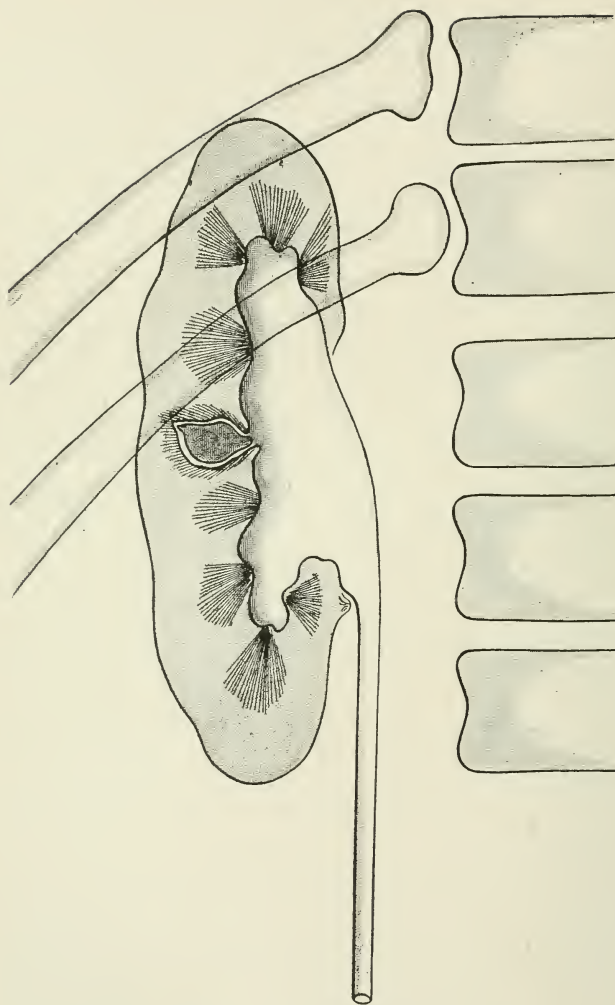


FIG. 1.—Diagram of renal calculus detected by the X-ray.

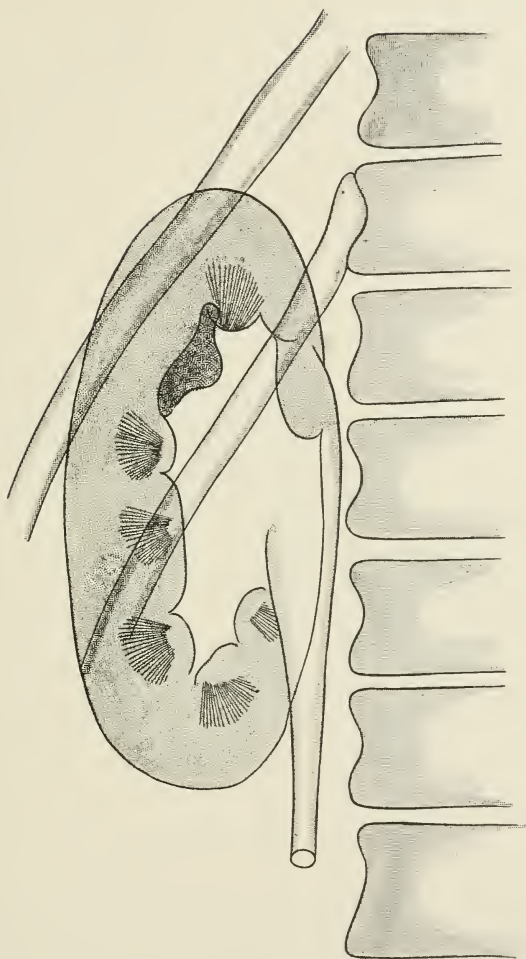


FIG. 2.—Sketch from X-ray, showing stone in kidney, made before operation.

the probe passed down to the ureter, and another time when it was in the pelvis of the kidney.

This puzzling search to determine its exact position, with many attempts to grasp the gritty point with curved forceps, occupied at least from twenty minutes to half an hour; finally the probe slipped into a small opening, at which a small, sharp point of the stone presented in the pelvis. (Fig. 1.) Along this a curved bistoury was introduced and split up the kidney tissue, after which the stone was quickly extracted. The stone was oval, one-half inch in its largest diameter, and quite black. Mixed oxalate and urates. Patient made an uninterrupted recovery, and since has been absolutely free from pain. Urine contained no pus. Discharged cured in four weeks.

CASE XX.—A lady, twenty-eight years of age, was sent to me by Dr. Crampton. She had been married four years, and had borne four healthy children. She first noticed pain in her right side, extending from spine to navel, two or three years before her marriage. Consultation of doctors, at that time, diagnosed probable stone in the kidney, and gave medicinal treatment. During her married life she had been somewhat better, severe attacks having occurred only once a year, the nature of the attack being fever, nausea, chilliness and pain, and the urine diminished in quantity with purulent sediment.

These attacks required her remaining in bed; she has never passed gravel. Before being seen by me she had a very bad attack, which gave her pain, as she expressed it, all around her waist; never passed blood. Examination of urine showed pyuria. Several radiographs were taken during two visits, one of half an hour, which gave negative results; one of fifteen minutes gave a fair shadow of a calculus, triangular in shape, between the eleventh and twelfth ribs, one and one-half inches from vertebral edge. One of five minutes and one of *one* minute, each gave unmistakable shadows corroborating the former, and being, if anything, more distinct; but in these, owing to slightly different position of the tube, the shadow rested upon the last rib. So exact was this picture that a sketch was made of it before operation, and locating it in the upper part of the kidney, because of the high shadow. (Fig. 2.)

This view was absolutely corroborated at operation, which

was done, July 24, 1898, at St. Luke's Hospital. There was then revealed the following most interesting condition: Incision was made through the greater curvature of the kidney into the pelvis; the kidney substance was one inch in thickness. Pus flowed freely from the pelvis; exploration failed, however, to discover the stone; the finger, being introduced, swept the entire pelvis

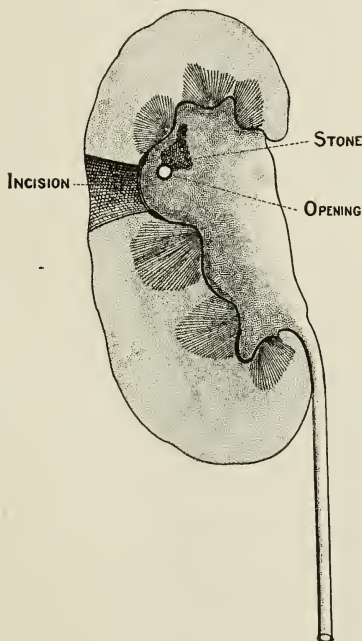


FIG. 3.—Showing location of small orifice leading from pelvis into pocket containing calculus.

of the kidney without discovering the stone, nor could anything be felt by palpation,—one finger in the kidney and one without. Further search being made with a metal probe, an occasional grating was noticed, but, as in the former case, could not be located. After a while even this was missed entirely, and further search would have been given up, and the diagnosis of simple

pyelonephrosis would have been made, had not the radiograph been so convincing. A small probe was again used and discovered in the upper third, on the posterior wall, not far from the incision, a little dimple with an opening just admitting the probe. (Fig. 3.)

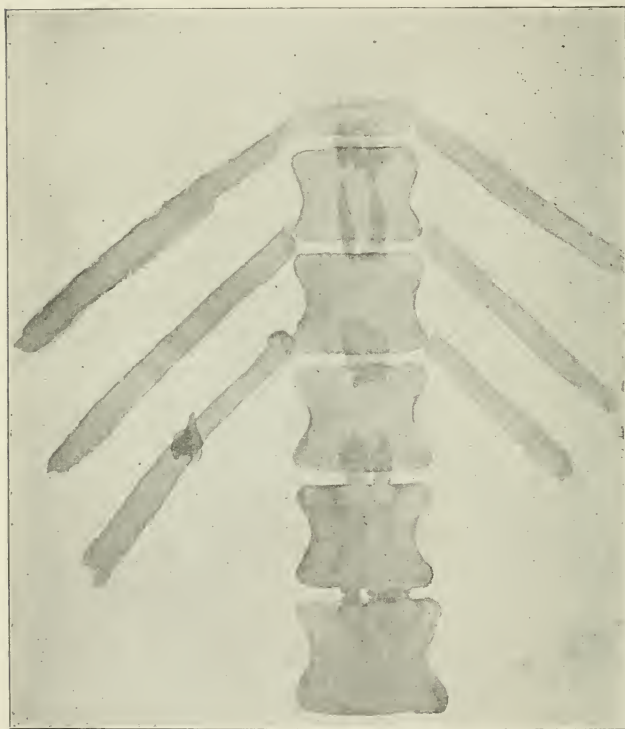


FIG. 4.—Sketch of X-ray, showing renal calculus one-half inch long and one-fourth inch thick at largest part, taken by one minute's exposure.

The probe quickly swept along the face of the stone, which occupied a pocket of its own, out of which one of its small points protruded intermittently, thus accounting for the difficulty of its detection. This pocket was split up along the probe and the

stone removed intact. The patient made an immediate recovery; sinus closed. The urine flow stopped about one week after operation. She remains perfectly well. The stone was of oxalate of lime.

It will be seen from these reports that stones of various sizes, down to one-half inch in largest measurement, have been unmistakably shown.

The case last reported by myself, I think, shows the stone of smallest measurement. Of an irregular triangular shape, the longest measurement one-half inch, it presented the thinnest aspect for penetration, only three millimetres at its thickest part, yet it gave an unmistakable shadow with the tube placed twenty inches from the plate, and one minute's exposure. (See Fig. 4.)

To appreciate the meaning of a skiagraph requires as much experience as the technique of taking them, and to the casual observer a plate that shows a few uncertain shadows can be interpreted with no uncertain meaning by an experienced eye.

Regarding the technique of picture-taking I would say, right here, that the following details are essential:

Delicate and Fresh Sensitive Plates.—Rubber tissue should be interposed between the patient and the plate to prevent perspiration dampening the paper. The fluoroscope is useless.

The photographic plate must be placed well up beneath the patient's back, including the last four ribs.

As to the machine and tubes, much has been written about the relative merits of the static machine and coil, hard tubes and soft tubes; but my own observation leads me to think that whatever will make a good bone shadow quickly will make a shadow of a calculus. The quality of a rib and the average renal calculus being not very different as to impenetrability. In the radiograph of the normal loin there should be no shadow of the kidney substance, the muscles, fascia, intestines, or abdominal wall, which should resemble in any way the shadow of a renal calculus.

Most cases of renal calculus in middle life can trace their earliest symptoms to youth, hence we may occasionally be able to detect small calculi in the easily taken young subject by a quick exposure; hence the opportunity of early removal of calculus before it has resulted in permanent damage to the kidney, will surely occur more frequently than heretofore. As to how small a calculus can be thus discovered, I will enumerate, among others, but one experiment.

Seven calculi, six renal and one urate, were made the subject of the following experiment: A large kidney having been sliced open, and these calculi distributed within it, an amount of meat (beefsteak) was placed on either side, to make in all four inches thickness. An exposure of ten minutes and one of fifteen minutes were made, and the subsequent development showed that the shorter exposure was more clear. The smallest stone, one-eighth of an inch, was perfectly appreciable. In the longer exposure this had almost disappeared from the plate.

This was also shown in plates on which many stones of equal density were placed. The contrasting impression of an easily penetrable stone (such as urates) was greater with very short exposures, which corroborates the effect seen in the cases narrated.

The most useful plates are often those which at first sight seem failures.

A wet plate may show nothing, but when dry and held in proper light, gives good results.

A thin plate, looked at in broad daylight, shows nothing, but when held in front of a brightly illuminated sheet of clean paper, will give good shadow pictures.

A thin plate will often display shadows, when moved rapidly from side to side under proper illumination, which would not appear to the observer when it is held quiet. As Shakespeare says, "Things in motion sooner catch the eye than what stirs not."

A dense plate that seems impenetrable will sometimes reveal exquisite detail of bone, etc., when illuminated cor-

rectly, either by direct or reflected sunlight, with a proper screening of the observer's eye.

A properly closed box, like a fluoroscope, adapted to the size of the picture, screens the observer well, and allows him to interpret shadows correctly.

Photographs never show as well as a study of the negative itself.

In conclusion, the discovery of renal calculi by radiography has been demonstrated in twenty-seven published cases, proved by operation. It is probable that in most people of spare habit, and in young subjects, a stone in the kidney can be found with reasonable certainty. The technical work of producing a successful radiograph is as yet not thoroughly studied out, but it seems probable that a quick-penetrating focus-tube, with very short exposure, will show stones that would be lost by long exposure.

OBSERVATIONS ON NEPHRALGIA, WITH RE-
PORT OF CASES SIMULATING STONE
IN THE KIDNEY, OCCURRING AT
THE MASSACHUSETTS GEN-
ERAL HOSPITAL.

BY JOSHUA C. HUBBARD, M.D.,

OF BOSTON.

I AM indebted to the members of the staff of the Massachusetts General Hospital for permission to publish the following cases:

CASE I.—F. P., thirty years old, entered the Massachusetts General Hospital on October 13, 1891.

Previous History.—Has never been seriously sick. Has had rheumatism. Gonorrhœa at fifteen years. Eight years ago had a sudden attack of severe pain in the left side. Two hours after the onset passed some gravel and two small stones. Large flow of urine followed. Felt badly for a few days. Has had no renal colic since.

Present Illness.—Has had pain in the left lumbar region for six or seven years; none in groin or testis. Two years ago free from it for a year. It has now become almost constant. Relieved by a change of position or a pillow in the small of the back. Increased by walking or working in a stooping position. Blood in the urine first noticed on August 14, 1891. It appeared after much pain in the loin. "Rode eighteen miles in a wagon. Got out and dropped, for he felt so sore. Passed water then and it was almost clear blood." Now micturates three times a day. Has lost twenty pounds of weight in six months. Lying on right side causes pain in left. When the pain is very severe, patient is drawn over to that side. Seeks aid because of the pain and blood in the urine.

Physical Examination.—Temperature, 98.5° F.; pulse, 80; respiration, 20. Marked tenderness on pressure over the left loin, above the middle of the crest of the ilium. Resistance greater on the left than right. No tumor felt. Right side of the prostate slightly tender. Examination without ether for stone in the bladder negative. Physical examination in other respects negative.

Urine examined by Dr. Scudder. Specific gravity, 1016, acid, bloody; much sediment. Urea and uric acid normal. Albumen $\frac{1}{8}$ per cent. Bile and sugar absent. Sediment: much blood, both altered and fresh; excess of leucocytes, single and in clumps. Numerous small, round, epithelial cells. No tubercle bacilli. Twenty-four hours' amount about forty ounces.

Operated on by Dr. A. T. Cabot, on October 20.

Semilunar incision in left lumbar region below last rib. The kidney was explored by a needle, and then its substance was incised and the pelvis explored. No stone was found and nothing abnormal was noted. Drainage-tube was placed in the pelvis of the kidney and a shorter one into the wound. Incision partially closed.

Patient was discharged, on November 10, with a deep sinus.

On December 8, 1898, seven years after the operation, he wrote, in answer to a letter of inquiry concerning his health. From the time of the operation till last spring he felt well enough to work and earn his living and gained in weight. Last May, however, he had a relapse, and suffered pain similar to that before the operation. From then till September he passed blood and pus and lost thirty pounds of weight. He then passed some gravel, and since then has been free from pain, has been gaining weight, and passes a clear urine.

CASE II.—F. M., forty-five years old, entered the Massachusetts General Hospital on March 27, 1894.

Previous History.—Five years ago had a fall, injuring only his face and ankle. A bubo at eighteen years of age. Habits good.

Present Illness.—Some five or six years ago had a sudden, severe pain in the right loin, running down to groin and testis. The attack lasted for eight to nine hours, and was accompanied with vomiting. Well after the cessation of the pain. Second attack came after an interval of a year, and since then they have been monthly. All attacks are alike, except that now he does not

vomit, and has slight diarrhoea rather than constipation, as at first. Has required much morphine. Never jaundiced. Has never passed any gravel or had any trouble with his micturition.

He had no attack during the week he was kept in the hospital for observation, and was discharged.

About a week later he was admitted, suffering an acute attack.

The pain was localized in his lumbar region, just below the ribs, and shot down into his testicle, which was not retracted. There was no tenderness on pressure. Pain changed after an hour to his groin. Vomited a few times. After about five hours the severe pain ended rather suddenly and persisted only as a dull ache. There was no change in the urine at any time.

Operation, by Dr. John Homans, April 24, 1894.

Incision below right ribs. Kidney so high up that lower edge was by twelfth rib. Nothing abnormal felt. Kidney not opened. Incision closed.

May 14: Discharged free from the old pain and well. I saw the patient in November, 1898. He told me that three months after leaving the hospital he had a reminder of his old attacks and again after another interval of three months. The pain was not severe and was not accompanied by vomiting. Since then he has been well, and is now better than for years. The scar was firm and gave no trouble. The urine was perfectly clear. Specific gravity, 1010, acid. No albumen or sugar. The sediment contained no crystals or pathological elements.

CASE III.—D. H., aged fifty-two years, entered the medical wards of the hospital on March 12, 1895.

Family History.—Mother died of cancer.

Habits.—Never used much alcohol; none for twenty years. Tobacco, fifteen cents' worth a week. Gonorrhoea once.

Previous History.—Measles and whooping-cough during adult life. Rheumatism in his joints, off and on, for twenty-five years. Stiff and sore, but never laid up. For one year has had considerable dyspnoea and palpitation with any exertion.

Present Illness.—Ten years ago began to pass bloody urine, and every three weeks or so had a paroxysmal pain in left side, lasting from five to fifteen minutes. For two years the urine remained bloody without any change in the amount. At the end of the two years had a very sharp attack of pain in his left (?)

side, above his hip, in front, and shooting down into his testicle and up into his lungs. The attack lasted all night. A few days later the urine ceased being bloody. For a period, then, of two years the urine was not bloody, except once or twice a year, and there was no pain. Six years ago bloody urine appeared again and has continued since. There was no recurrence of the pain, except for slight twinges, till January, 1895, when there was a sudden sharp paroxysm of pain in the right side, shooting down to the testicle, which lasted three or four hours as twinges, and recurred every night for five or six days. Vomited once. Felt feverish and sweated freely, but had no chills. Coincident with the attacks the urine became bloody, and large clots were passed. Micturition frequent. Urine has been bloody ever since, less now, however, but contains more whitish matter. Since then has had no more sharp attacks of pain; for last three or four months some steady pains in small of back, not increased by jolting. Since he has been passing clots has had the urine stop in the middle of the stream, and then go on again after a change of position. Never had any cedema, headache, cough, or jaundice. Eyesight has failed for a year. Digestion good. Bowels regular. No loss of weight. Feels weak. Any work makes the urine worse.

Physical Examination.—Soft systolic murmur at the heart's apex transmitted slightly to axilla. Apex-beat in fifth space, four and two-tenths inches from middle line. Mass felt in right side of abdomen, descending with respiration. Ankle clonus present. Knee-jerks lively. Examination otherwise negative.

Blood Examination.—Red corpuscles, 3,048,000; white corpuscles, 7500; hæmoglobin, 30 per cent.

Urine Examination (by Dr. Wood).—Specific gravity, 1015, slightly acid; albumen, $\frac{1}{4}$ per cent. Bile and sugar absent. Sediment: chiefly blood, few calcic oxalate crystals, and a considerable number of acid sodium urate groups. No tubercle bacilli were ever found in his urine, and he was transferred to the surgical wards of the hospital, where he had an attack of pain severe enough to double him up. The pain was of gradual onset and ending, and was constant for two hours.

March 28: Operation by Dr. Cabot. Incision parallel to the ribs. Kidney found lying high up under the ribs. The needle grated on something as it explored the kidney. Incision one and one-half inches long, through the posterior edge and pelvis of the

kidney; explored without finding any stone. Kidney again needled, with negative result. Drainage-tube passed into pelvis of kidney and cortex stitched together about it. Incision partially closed.

April 25: Discharged to Convalescent House.

May 5: He returned from the house to the medical wards. Urine had been clear till three days previous, when it became bloody, and has remained so ever since, very red at entrance. No pain or temperature.

Blood Examination.—Red corpuscles, 4,340,000; white corpuscles, 8000.

Urine Examination (by Dr. Wood).—Amount in twenty-four hours, fifty-three ounces, alkaline; specific gravity, 1017; albumen, $\frac{1}{8}$ per cent.; sugar absent. Sediment: chiefly blood, pus, and triple phosphate crystals. Few other crystals and fatty cells. Few brown granules, and an occasional blood or fibrous cast, some with renal cells and leucocytes adherent.

Patient was kept in bed and had piperazine every four hours.

In five days the urine was clear, and he was discharged on May 20.

I heard from the patient about the end of 1898, more than three years after the operation. He says he has had a few attacks of bleeding, always promptly checked by some medicine given him at the hospital. For the last three or four months he has been worse, the medicine not seeming to have the desired effect. He has much heavy work to do, often overworking.

CASE IV.—G. B. A., aged fifty-eight years, entered the hospital on February 1, 1897.

Family history good.

Previous History.—Usual children's diseases. Gonorrhœa six years ago.

Present Illness.—Five or six years ago began to have intense pain across the small of the back, principally on the right side. The attacks of pain were usually followed by the passage of gravel, of which a large amount has been passed, off and on, for the last five years. The largest piece was the size of a pea. Micturition frequent. Walks with care for fear of a misstep starting up an attack, which are so severe that life is scarcely worth living. He has been treated in the Out-Patient Department for a stricture, sounds up to No. 27 having been passed.

Urine, acid; specific gravity, 1011; very slight trace of albumen; no sugar. Sediment: pus, free and in clumps.

February 6: Operation, by Dr. C. B. Porter. Incision on the right side just below the ribs, extending downward and forward to the anterior superior spine. Kidney needled. No stone felt. Kidney incised and explored by the finger with negative result. The inside of the kidney was then syringed out but no stones brought away. Wick left in the kidney and incision partially closed.

Immediately following this operation he had considerable pain in his back and kidney, and was discharged on March 10.

Under the date of November 24, 1898, more than a year and a half after the operation, he writes that he is quite a well man, free from pain, and is troubled less from frequency of micturition. For a time after his discharge from the hospital he passed a sandy substance. Now, however, this has stopped and he passes no gravel. The urine contains no blood. He is suffering with attacks of pain in his chest, shooting into his arm.

CASE V.—S. E. H., aged twenty-four years, entered the hospital on March 29, 1897.

Family history good.

Previous History.—Typhoid ten years ago.

Present Illness.—Last September, while lying in bed, had an attack of severe pain early in the morning. The pain was in the left side of the abdomen, starting below the ribs, and running down into the pelvis. There was no vomiting, but considerable sweating. After three hours the pain stopped suddenly, leaving only some soreness behind. The second attack was in February, 1897. The pain began as before, below the ribs, and ran down into the testicle, and was accompanied with nausea, vomiting, and sweating. Required two hypodermic injections of morphine. The pain lasted all day, and stopped rather suddenly. No urine was passed till the pain had ceased. From that time he has had attacks at intervals of a few days, all of them resembling the second attack. He has never noticed any blood, stones, or gravel in his urine. He enters the hospital in an attack.

Physical Examination.—Well developed and nourished. Heart and lungs negative. Abdomen tender over the course of the left ureter and also slightly tender over the region of the kidney behind. As long as he remains quiet no discomfort.

Urine, specific gravity, 1025; no alkaline or sugar.

Before he was operated on he had six attacks of varying intensity, some accompanied by vomiting and most requiring morphine, one as much as one-half grain hypodermically. He had no fever. At one time a few red corpuscles were found in the urinary sediment.

April 14: Operation, by Dr. M. H. Richardson. Incision from the lower border of the ribs, at about posterior axillary line, downward and forward to the crest of the ilium. Peritoneum pushed forward. Ureter seen and palpated from pelvis to bladder without finding anything abnormal. The kidney was then incised along the convex border from the middle to its lower edge, and explored by the finger. No stone felt. A probe was then passed from the pelvis of the kidney through the ureter to the bladder without detecting any obstruction. One deep stitch was taken through the kidney, and the incision was partially closed.

He was discharged on May 12, having had no pain since the operation.

On December 7, 1898, a year and three-quarters since the operation, he writes that he has gradually improved and has no pain in that side. Last August he had a severe attack in the other side, due, he thinks, to a severe cold. He passed no stones, but at one time some blood, which he thought was due also to a cold. He has not quite recovered from the general effects of a serious operation, and feels it advisable to pass the winter in the south.

SUMMARY.

Case I was well for six and a half years, and then, after suffering for a time, passed some gravel. It seems as if this attack could have nothing to do with the first, for it is not probable that the position of gravel, so situated in the kidney as to cause symptoms, could be changed in such a way by an operation, at which it was not discovered, as to remain latent for six and a half years. I classify this case, then, among the cured.

Case II has been four years without any symptoms, and therefore can be considered well.

CASE III: The outcome of this case seems still doubtful, as the patient, since the operation, has had various attacks of

hæmaturia. Were these attacks due to stone, one would expect that during these three and a half years the calculus would have continued to cause the same dull pain as previous to the operation. If the blood came from a neoplasm, the man's general condition would be worse than it is, for the history of hæmaturia covers a period of thirteen years. The same applies to tuberculosis of the urinary tract, for, as Senn says, in primary renal tuberculosis life is seldom prolonged beyond two or three years without timely surgical treatment. The fact that tubercle bacilli were not found in the urine is of slight importance, as they are demonstrable in only about one-half the cases (Senn). In view, however, of the case of renal tuberculosis recently reported by Reynolds (*Johns Hopkins Bulletin*, February-March, 1898), the diagnosis must still be held in abeyance, for his patient suffered from symptoms for eight years previous to the operation, at which an incipient tuberculosis of the kidney was found. The patient has certainly been relieved, for the hæmaturia is now intermittent at long intervals against constant, as before the operation, and the pain has disappeared.

Case IV has been cured by the operation, one year and eight months having elapsed. The cure, however, was gradual, as some of the symptoms persisted for a while after his discharge from the hospital.

Case V: The final result is still doubtful, for, during the one and three-quarters years that have passed since the operation, he has had an attack of hæmaturia, which he ascribes to a cold. However, he has been free from the severe pain. He can certainly be said to have been relieved. It is of great interest to hear that he has had a similar attack in his other kidney, and perhaps he may return for the splitting of its capsule.

Of these five cases, three have been cured and two relieved, with still some doubt as to the final outcome in both of them. In four of the five operations the capsule was divided by the exploratory incision in the kidney. Of these four, two have been cured and two relieved. In the fifth case

the kidney itself was not explored in any way, and was only freed from its connections sufficiently to permit of palpation. This resulted in a cure. Finally, in two of the three operations resulting in a cure the kidney was incised and in one it was not.

Nephralgia is a symptom and not a disease, and when used in the latter sense is certainly not a scientific term, meaning, as it does, pain in the kidney. In many cases, no doubt, it serves as a cloak for ignorance, yet in a few it seems to have a more or less definite and proper use. Under this heading are placed such cases of pain in the kidney as cannot be classified under some one of the various other renal affections. Nephralgia, then, stands for a necessarily somewhat heterogeneous collection of diseases.

Etiology.—In the short paragraph devoted to this subject in Dennis's "Surgery," nephralgia is said to occur more frequently in neurotic women than in men. The cases I have collected do not seem to agree with this statement. Including the five cases I have reported there are twenty-four men and eight women, or the disease is three times more common in men than women.

Adults appear to be the most common subjects with nephralgia, the average age being thirty-nine, the youngest twenty-one, and the oldest sixty-five.

A certain number of operators have advanced theories trying to explain their individual cases, but most men have accepted the facts without theorizing. There results, then, a list of various causes. Whipple's patient, previous to the operation, ate much rhubarb, which, by causing an excess of oxalate of lime crystals, irritated the kidney. After the operation all rhubarb was stopped, and the patient recovered. An excess of uric acid may act in a similar way.

Perinephritis following blows or strains, by the thickening and cicatrization of the perirenal tissue, may exert sufficient pressure on the kidney itself or on the nerves about it to cause pain.

In still other cases the tension of the capsule of the kid-

ney has been considered too great, as evidenced where it is split, by gaping of the wound with protrusion of the kidney substance. In most of such cases no cause for this increased tension is assigned. In Tiffany's case, however, it was due to the cicatrization of a scar in the capsule. Somewhat similar are those cases, reported by Harrison, of marked albuminuria, some following scarlet fever, and therefore being suggestive of a nephritis, which were cured by opening the kidney and relieving the existing congestion.

Abnormal mobility, not sufficient to be detected by methods of physical examination, may cause the nephralgia by pulling on the vessels or ureter, or by permitting the kidney to rotate in such a way that a kink is formed in the vessels or the ureter, with a resulting change in the normal pressure. This abnormal position may be dependent on various postures or motions, and therefore be intermittent. It naturally follows that the symptoms will come in paroxysms. In one case the ureter had become caught over the vessels, in such a way as to cause marked congestion, by shutting off some of the venous return. Morris speaks of a "cinder-sifting" motion, which he found quite frequently in his cases, and which he considered the cause of the pain.

The following case has been explained in still another way: The patient, previous to the operation, had passed bits of stone. At the operation no stone was found, and yet a cure resulted. The theory advanced by the operator is that the kidney, in its congested state, was unable to cope with the injuries to its substance caused by the gravel. After the operation, by which the pressure was relieved, it was placed in a condition favorable for healing, which promptly occurred.

In some cases the pain may be neuralgic or associated with functional renal disease. The stretching or division of the nerves necessarily taking place at the time of the operation ends the disturbance (Morris). We have analogous cases in epilepsy, reported by White and Wood, where the convul-

sions have ceased after an incision of the scalp or a trephining of a healthy cranial bone.

Two of the above theories seem most commonly to offer explanation of the cases,—excessive mobility and increased tension about the kidney substance.

Pathology.—The pathology varies with the cause, and very little has been written concerning it. In a few cases the symptoms have seemed severe enough to warrant a nephrectomy, and then the kidney is described as being normal, though I have not found in any such case a microscopic examination. A congestion of the kidney has been noticed in many of the cases, due to a disturbance of the normal pressure from one cause or another.

A pyelitis, so slight, in fact, that it can be detected only by the microscope, may result from a long-continued obstruction in the ureter. Dr. McBurney reports such a case, where nephrectomy was done after a negative nephrotomy for stone. No stone was found. The pathologist reported that macroscopically the kidney was normal, though microscopically a hæmorrhagic pyelitis existed (Kammerer).

Swelling of the mucous membrane of the pelvis may occlude one of the papillæ, with resulting obstruction of urine in that portion of the kidney. This leads to severe pain, unless the capsule is sufficiently elastic to permit distention, for otherwise the convoluted portions of the urinary tubules and the Malpighian bodies, being in the cortex, have to bear the brunt of the increased pressure.

In regard to the increased tension from the capsule, it may be said that, as many of the cases cured by operation have not had the capsule split, this cannot be a general cause. The only procedure common to all the cures is a freeing of the kidney sufficient to permit of palpation. In certain others the pelvis has been opened for exploration, but I doubt if a simple incision in the pelvis would affect the capsule. In only sixteen of the twenty-six cases cured by operation, where it was reported in enough detail to tell, was the capsule split. This proportion may be large, as I have considered that the

capsule was incised when the operator is said to have opened the kidney for digital exploration, which, of course, might have been done through an incision in the pelvis.

Diagnosis.—As the symptoms are often those of stone in the kidney, the differential diagnosis is extremely difficult and rarely made. The age of the patient is of no help, as the average of seventy-one cases of renal calculus is thirty-three and seven-tenths years, as compared with thirty-seven for nephralgia. Males, as we have seen, are about three times more commonly affected with nephralgia than women, while in stone the proportion is about equal,—males forty-two, females thirty-four, out of seventy-six cases. In nephralgia the symptoms referred to the left kidney in six cases and to the right in seventeen, whereas, on the other hand, stone was found in the left kidney in thirty-two cases as against thirty-seven in the right. The pain in nephralgia in nineteen males radiated to the testicle in nine, while in thirty-two stone cases the pain was referred to the groin, penis, or bladder in but nine. From this it follows that the involvement of the testicle is a little more common in nephralgia. The urine gives the greatest aid in diagnosis. In twenty cases of nephralgia, the urine was free from blood, pus, or crystals in seven, or in almost one-third of the cases, whereas in fifty-seven cases of stone, it was free from the above abnormal elements in but two. Stone in the kidney may occur, of course, with a perfectly normal urine, for only where it is forming are crystals to be expected in the urine (Ranshoff), and only while it is hollowing out a place for itself in the kidney, or growing in a calyx or the pelvis, is there a pyelitis. As soon as it becomes encysted the inflammation may stop (Morris). The urine may also be normal in those cases where the flow is stopped, at least temporarily, from the diseased kidney by the impaction of a stone in the ureter. However, in most cases where the symptoms are sufficiently persistent and severe to warrant the diagnosis of stone the urine will be found abnormal. With regard to distinguishing the urine of a pyelitis from that of a cystitis, it is said that the reaction in the former is

usually acid, while in the latter alkaline. Cystoscopy may be of aid in determining which kidney is diseased. The Röntgen ray is of only slight help, for (Ringel) it has been found experimentally that only oxalate of lime or uric acid calculi cast a shadow on the plate, while phosphatic stones offer no resistance to the passage of the rays. For convenience I have tabulated the three aids, and practically they are the only ones to the differential diagnosis.

NEPHRALGIA.

RENAL CALCULUS

Three times more common in males than females. Equally.

Right three times as often as left. Equally.

Urine normal in one-third the cases.

Urine normal in one twenty-sixth the cases.

The diagnosis from tuberculosis of the kidney may at times be difficult. Of course, the discovery of tubercle bacilli in the urine or a reaction following the injection of tuberculin are important aids. A negative examination of the urine for bacilli is of slight importance, and in such a case the catheterization of the ureters and the injection of the two specimens of urine into guinea-pigs should be carried out. As primary renal tuberculosis is rather rare, there will often be some additional foci in the course of the genito-urinary tract which can be more definitely demonstrated.

Operation.—Ordinarily the diagnosis of stone will be made and the operation undertaken for its relief. If none is located by palpation or acupuncture, which is a rather inexact procedure, the kidney should be incised and examined carefully, not only with the finger but by a probe. As many of the primary tubes are more than an inch in length and no larger than a No. 10 catheter, while the secondary tubules are as fine as knitting-needles, a thorough examination by the finger alone is impossible (Greig Smith). The ureter should also be probed, as the stone may previous to the operation have passed into it or have been forced out of the kidney by the manipulations. If nothing abnormal can be found, the capsule should be split from pole to pole unless the inci-

sion into the kidney has divided it sufficiently. It is advisable, I think, to anchor the kidney in place before closing the operation.

Prognosis.—As only a few unsuccessful cases, where the pain has returned after varying intervals (Wright), or where a stone has been found after a secondary nephrectomy (Morris and Shepherd), have been published, no percentage of cures can be made. It must, however, be acknowledged, after considering the cases at the Massachusetts General Hospital and the following table, that cure does follow in a certain proportion of cases. If any abnormal position or mobility has been detected and rectified by the operation, the chances of a cure are so much the greater. The operator, however, must remember that in a few cases the symptoms of a diseased kidney are transferred entirely to the well side.

LITERATURE.

- Senn: Tuberculosis of the Genito-Urinary Organs.
 Jacobson: British Medical Journal, 1890, Vol. i.
 Duke: Indian Medical Gazette, 1895, Vol. xxx.
 Anderson: Lancet, 1899, p. 775.
 Whipple: Lancet, December 13, 1890.
 Neve: Lancet, March, 1897.
 Harrison: Liverpool Medico-Chirurgical Journal, 1898, Vol. ix.
 Lambret: Revue de Chirurgie, 1897, Vol. xvii.
 Morris: British Medical Journal, 1885, 1888, 1892; Surgical Diseases of Kidney, Lea Bros., Phila.
 Grieg Smith: Surgery.
 Ransohoff: Journal American Medical Association, 1895, Vol. xxv.
 Kammerer: ANNALS OF SURGERY, 1898.
 Johnston: Southern Surgical and Gynæcological Transactions, 1896, Vol. ix.
 Winslow: Maryland Medical Journal, 1896.
 Newman: London Clinical Society's Transactions, Vol. xxx.
 Dennis: Surgery.
 Horwitz: International Clinics, Sixth Series, Vol. iv, 1897.
 Tiffany: ANNALS OF SURGERY, 1889.
 Briddon: ANNALS OF SURGERY, 1889, Vol. xxvii.
 White: ANNALS OF SURGERY, 1891.
 Southam: Medical Chronicle, Manchester, 1892-93.
 White and Wood: ANNALS OF SURGERY, 1897.

Thornton: Medical Press and Circular, December, 1889.

Shepherd: ANNALS OF SURGERY, 1889.

Ringel: Centralblatt für Chirurgie, December 10, 1898.

Wright: Medical Chronicle, 1888-89, Vol. ix.

CASES OF NEPHRALGIA CURED BY OPERATION.

CASE I.—Male, aged twenty-two years. *Duration*, four years. *Symptoms*, paroxysms of severe pain in lumbar region; vomiting; disturbance of micturition four to five hours before attack; chill, headache, coated tongue, constipation; pain from lumbar region to umbilicus; testicle not retracted; no gravel or blood passed; urine seems decreased. *Result*, three months without recurrence. *Cause*, unknown. *Operation*, kidney normal in appearance; palpation; exploration through incision in pelvis negative; probe and bougie passed to bladder; no stone. *Urine*, alkaline; no pus or blood; amorphous phosphates present. *Reported by*, Briddon.

CASE II.—Male, aged forty years. *Duration*, three years. *Symptoms*, periodic attacks of renal pain; distinct but slight tenderness over right kidney. *Result*, seven months without recurrence. *Cause*, unknown. *Operation*, palpation; acupuncture; pelvis incised. *Urine*, oxalate crystals; traces of pus. *Reported by*, Neve.

CASE III.—Male, aged forty-nine years. *Duration*, seven years. *Symptoms*, sudden attack of pain in right loin seven years ago; pain starts in loin and radiates to groin and hypogastrium; frequent attacks; frequent micturition. *Result*, three months without recurrence. *Cause*, rhubarb eaten causing oxaluria. *Operation*, palpation; acupuncture. *Urine*, acid; specific gravity, 1010; trace of albumen; pus; blood; oxalate of lime crystals. *Reported by*, Whipple.

CASE IV.—Female, aged twenty-four years. *Duration*, four years. *Symptoms*, hæmaturia with sharp pain in loin and groin; paroxysm every three to six days; subject to neuralgias; tender on pressure outside erector spinæ, below ribs. *Result*, three and a half years since operation; well for five weeks; relapse and neuralgia about head for seven weeks; another slight recurrence; well since. *Cause*, unknown. *Operation*, palpation; acupuncture. *Urine*, abundance of exudation; corpuscles. *Reported by*, Anderson.

CASE V.—Female, aged forty-nine years. *Duration*, three years. *Symptoms*, sudden intense pain in right loin, extending to median line, bladder, and groin; pressure over kidney painful. *Result*, five months without recurrence. *Cause*, stiff, hard scar on kidney, with increase in tension. *Operation*, palpation; acupuncture; incision of pelvis; each calyx explored by sound; capsule incised; wound gaping. *Urine*, acid; specific gravity, 1022; pus and few blood-corpuscles. *Reported by*, Tiffany.

CASE VI.—Male, aged twenty-six years. *Duration*, ten years. *Symptoms*, severe pain in right kidney, constant and paroxysmal; testicle retracted; by palpation right kidney larger, firmer, more tender than left. *Result*, nine months without recurrence. *Cause*, tension from capsule.

Operation, palpation of kidney and ureter; acupuncture; capsule split with bulging kidney substance. *Urine*, normal. *Reported by*, Johnston.

CASE VII.—Male, aged sixty-five years. *Duration*, not known. *Symptoms*, constant pain in right loin; gastric disturbance; irritability of bladder; pain at times passes down ureter to glans penis; retractile testicle; no stone in bladder. *Result*, five years without recurrence. *Cause*, tension of capsule. *Operation*, acupuncture; capsule split with bulging kidney substance. *Urine*, no blood or pus. *Reported by*, Johnston.

CASE VIII.—Male, aged twenty-eight years. *Duration*, not known. *Symptoms*, pain in left kidney; frequency of micturition with tenesmus; sounded for stone in bladder with negative result. *Result*, two years without recurrence. *Cause*, unknown. *Operation*, kidney opened and explored. *Urine*, occasionally blood and pus. *Reported by*, Johnston.

CASE IX.—Male, age not known. *Duration*, two years. *Symptoms*, symptoms of stone in right kidney. *Result*, two years without recurrence. *Cause*, unknown. *Operation*, incision for digital exploration. *Urine*, unknown. *Reported by*, Horwitz.

CASE X.—Male, aged twenty-eight years. *Duration*, eight months. *Symptoms*, dull, aching pain in lumbar region, paroxysmal; at times pain along ureter to testicle; increased by exertion; kidney tender on pressure. *Result*, one and a half years without recurrence. *Cause*, unknown. *Operation*, palpation; acupuncture. *Urine*, urea 2 per cent.; specific gravity, 1018; albumen present; excess of uric acid; few blood-corpuscles; no pus; in twenty-four hours amount normal. *Reported by*, Horwitz.

CASE XI.—Male, aged forty-five years. *Duration*, two years. *Symptoms*, pain in small of back, left side, extending at times to testicle; at first paroxysmal, then almost constant; pressure over kidney painful. *Result*, eight months without recurrence. *Cause*, unknown. *Operation*, palpation; acupuncture; incision for digital exploration. *Urine*, urea 2 per cent.; specific gravity, 1020; albumen present; blood-corpuscles; no pus. *Reported by*, Horwitz.

CASE XII.—Male, aged twenty-eight years. *Duration*, three years. *Symptoms*, attacks of severe pain in right kidney; hæmaturia for a year; kidney painful on palpation. *Result*, six months without recurrence. *Cause*, unknown. *Operation*, palpation; acupuncture; incision and digital exploration; nephrorrhaphy. *Urine*, specific gravity, 1026; few leucocytes and oxalate of lime crystals. *Reported by*, Ransohoff.

CASE XIII.—Female, aged thirty-two years. *Duration*, not known. *Symptoms*, constant pain on right side; tender; mass felt on palpation. *Result*, three months(?) without recurrence. *Cause*, fall, with hæmatoma in intercosto-iliac space; capsule adherent, thick, fibrous; kidney abnormally hard. *Operation*, incision, whole length. *Urine*, unknown. *Reported by*, Lambert.

CASE XIV.—Female, age not known. *Duration*, not known. *Symptoms*, constant dull pain in left loin and back, with exacerbations; micturition frequent and difficult; stones previously passed; severe hæmaturia. *Result*, one year without recurrence. *Cause*, unknown. *Operation*, kidney opened. *Urine*, uric acid crystals. *Reported by*, Thornton.

CASE XV.—Male, aged twenty-nine years. *Duration*, ten years. *Symptoms*, sharp pain in right lumbar region, shooting to testicle and head of penis; rigors and vomiting; palpation painful; almost complete suppression of urine during an attack, followed by more free flow; sounded for stone in bladder negative. *Result*, two years since operation; in last year three slight similar attacks on other side. *Cause*, kidney tough and cirrhotic. *Operation*, palpation; acupuncture; incision in pelvis; examination of kidney and ureter with finger and sound. *Urine*, specific gravity, 1020; no blood; forty ounces in twenty-four hours. *Reported by*, Southam.

CASE XVI.—Male, aged forty years. *Duration*, four years. *Symptoms*, pain in right side, extending along ureter to testicle, rarely to left renal region; hæmaturia; attacks with nausea, vomiting, fainting, gastrodynia; sudden cessation of the pain. *Result*, eight months without recurrence. *Cause*, strain; kidney rotated with kinking of ureter over renal vessels. *Operation*, capsule incised and peeled off a little; kidney bulged in wound; nephrorrhaphy. *Urine*, when free from blood, normal. *Reported by*, Newman.

CASE XVII.—Male, aged fifty years. *Duration*, six months. *Symptoms*, severe pain in left kidney, shooting down and forward; exercise caused paroxysms; hæmaturia. *Result*, five months without recurrence. *Cause*, rotation of kidney. *Operation*, capsule incised and peeled off a little. *Urine*, when no paroxysm, normal; during paroxysm, casts and blood. *Reported by*, Newman.

CASE XVIII.—Male, aged fifty-three years. *Duration*, five years. *Symptoms*, pain in right lumbar region, paroxysmal, shooting to groin and testis, with sweating and vomiting; palpation painful; increased resistance on right. *Result*, four months without recurrence. *Cause*, kidney movable. *Operation*, capsule incised; nephrorrhaphy. *Urine*, normal. *Reported by*, Newman.

CASE XIX.—Female, aged thirty-five years. *Duration*, four years. *Symptoms*, paroxysmal severe pain on left side. *Result*, one year without recurrence. *Cause*, unknown. *Operation*, capsule incised. *Urine*, normal. *Reported by*, Duke.

CASE XX.—Male, age not known. *Duration*, three to four years. *Symptoms*, left renal colic, radiating to testes; hæmaturia. *Result*, no recurrence. *Cause*, kidney enveloped in firm mass of fibrous tissue. *Operation*, kidney incised. *Urine*, unknown. *Reported by*, Kammerer.

CASE XXI.—Female, aged thirty-five years. *Duration*, one year. *Symptoms*, acute attacks of renal colic, with considerable hæmaturia. *Result*, one and a half years; no recurrence. *Cause*, unknown. *Operation*, acupuncture. *Urine*, unknown. *Reported by*, Harrison.

CASE XXII.—Male, age not known. *Duration*, not known. *Symptoms*, right renal colic; had passed stones previously. *Result*, six months; no recurrence. *Cause*, unknown. *Operation*, digital exploration; trocar inserted in several places. *Urine*, unknown. *Reported by*, Harrison.

CASE XXIII.—Male, aged twenty-one years. *Duration*, not known. *Symptoms*, pain in left loin; hæmaturia; fulness and tenderness on palpation in loin. *Result*, four years without recurrence. *Cause*, upper one-

half of kidney abnormally hard and tough; perirenal tissue toughly adherent. *Operation*, unknown. *Urine*, unknown. *Reported by*, Morris.

CASE XXIV.—Female, aged fifty-one years. *Duration*, not known. *Symptoms*, pain in right kidney, radiating to groin; vomiting; frequent micturition; urine frequently bloody. *Result*, three years without recurrence. *Cause*, strain of back; perinephritic tissue matted together. *Operation*, unknown. *Urine*, unknown. *Reported by*, Morris.

CASE XXV.—Male, aged thirty-five years. *Duration*, not known. *Symptoms*, simulating stone. *Result*, two years without recurrence. *Cause*, perinephritic tissue tough, firmly adherent to kidney. *Operation*, unknown. *Urine*, unknown. *Reported by*, Morris.

CASE XXVI.—Female, aged thirty-three years. *Duration*, two years. *Symptoms*, hæmaturia and other symptoms of renal calculus. *Result*, one year without recurrence. *Cause*, perinephritic tissue tough, firmly adherent to kidney; scar on kidney. *Operation*, unknown. *Urine*, unknown. *Reported by*, Morris.

CASE XXVII.—Male, aged thirty-four years. *Duration*, three years. *Symptoms*, pain in right loin, shooting along abdomen to testicle; vomiting. *Result*, no recurrence. *Cause*, kidney movable. *Operation*, nephrorrhaphy. *Urine*, pus; blood; oxalate of lime crystals. *Reported by*, Morris.

CHONDROCARCINOMA OF THE TESTICLE.

BY ARNOLD CADDY, F.R.C.S. (ENG.),

OF CALCUTTA, INDIA.

THIS case has been brought forward for publication partly because of its pathological rarity and partly on account of the interesting clinical history.

Mr. G. T., aged twenty-nine years, single, working in Calcutta as a merchant's assistant. A European, born and bred in New Zealand. He always lived an athletic life in that colony till the age of twenty-six, when he came to Calcutta.

In December, 1894, he was struck by a cricket-ball on the right testicle. He had considerable pain at the time of the accident, which rapidly passed off, and he did not lie up. No swelling appeared until a week later, when he noticed the bottom of the testicle begin to get hard, and it remained so until October, 1895, when the testicle began generally to increase in size and the hardness to spread upward. He was seen by me for the first time in September, 1896. The testicle was then the size of a duck's egg, painless, generally hard, and somewhat heart-shaped, the upper part of the testicle being the most swollen. As there had been no recent increase in the size of the organ, it was decided to wait and watch its growth; it was seen from time to time, and no further perceptible enlargement was noticed. In December, 1897, he had an attack of enteric fever, and when convalescent, he was sent off to New Zealand for a change, and was four and one-half months away from Calcutta. On his return, on the 4th of June, 1898, he weighed 174¾ pounds. During the first week of November, 1898, he began to feel pain and tenderness in the testicle for the first time since the accident, chiefly at the spot where the cord joined the testicle. A fortnight later the gland began suddenly to increase in size.

On the 14th of December, 1898, he again came to me; the

testicle was then the size of a small shut fist; it felt generally hard, and was tender everywhere. The cord was not thickened, no glands could be felt in the groins, and no swelling in the region of the iliac glands was discernible. A diagnosis of probable sarcoma of the testis was made. On the 17th of December, 1898, it was removed.

The removed testicle was the size of a shut fist. When it was laid vertically, no testicular tissue was apparent to the naked eye; the whole gland appeared to be infiltrated with a growth. At the upper and back part a nodule of cartilage was cut through the size of a nutmeg. The specimen was placed in 5 per cent. formol solution, and a microscopic examination was later made by Major I. F. Evans, I.N.S., professor of Pathology at the Calcutta Medical College, who reported as follows on the 9th of February, 1899:

"The testicle is the seat of a chondrocarcinoma, the cartilage is located in the neighborhood of the epididymis, and is surrounded and interrupted by many cysts lined by columnar epithelium. The cancer is of the medullary kind."

Professor Evans added that the majority of the tumors of the testicle that had reached him in the past two years had been sarcomatous. So far he had only been able to find chondrocarcinoma of the testis described and figured in the last edition of Ziegler's "Special Pathological Anatomy," published in 1897, Chapter 102, Article 309, pp. 990, 991, where, after describing carcinoma testis, it goes on to say:

"Carcinomata likewise in many cases contain rounded nodes and nodules or elongated, ramified, and cactus-like patches of cartilaginous tissue, chiefly in the neighborhood of the rete testis and epididymis. These patches, as they grow, sometimes break into the lymphatics and seminal canal of the testis, and therein ramify, assuming the most diverse forms. In this case we might distinguish the tumor as chondrocarcinoma."

The microscopic sections of the growth, in this case, correspond with the above description, and show cystic tubules of the epididymis and cartilaginous patches, with nests of cancer-cells very similar to the figure (No. 500) in the text.

The clinical history is very interesting from the long period of time during which the disease remained quiescent,

from the date of the original injury, in 1894, until the growth suddenly began to increase in size, a period of nearly four years.

Professor Evans kindly consented to join me in the publication of this case, and the preparation of a paper on the pathology of what in this country is a rare form of testicular new growth. Unfortunately, before this could be carried into effect, Professor Evans, who had been making autopsies on some cases of bubonic plague, contracted that disease, and died at his post on the 13th of March, 1899, to the great regret of all the medical profession in this city.

ANTERIOR DISLOCATION OF THE CARPAL SCAPHOID BONE; CONGENITAL MAL- FORMATION OF THE CLAVICLE.

BY ALFRED KING, M.D.,

OF PORTLAND, ME.,

SURGEON TO THE MAINE GENERAL HOSPITAL.

(I) A CASE OF ANTERIOR DISLOCATION OF THE CARPAL SCAPHOID BONE.

(I) THIS case is reported because I cannot find another like it on record, and because it can be illustrated by a skiagraph.

Mr. R., aged twenty-one, a student of Bowdoin College, while exercising in the gymnasium on February 6, 1899, attempted to turn from some swinging rings and alight on some mats. By some mishap he landed on his hands and knees on the floor, striking, however, his right hand, palm down, on the edge of the mats. On rising he noticed a small bunch on the outer side of the front of his wrist. This was soon concealed by the swelling, so that when Dr. F. N. Whittier, director of the gymnasium, saw him, all that could be made out was a badly sprained wrist. The part was put in splints. When these were removed, two weeks later, the swelling was gone, but the prominence remained. This was shown to be due to an anterior dislocation of the scaphoid by an excellent skiagraph, made by Professor Hutchins. A few weeks later a surgeon attempted to reduce it by manipulation, force, and the assistance of ether. His efforts seemed to him sufficiently satisfactory to warrant his putting it in splints again. The student then went to his home, in an adjacent State, where the splints were removed in two weeks by his family physician, who found the bone out of place and causing great

impairment of function. He was then referred to me with a view to an operation.

I found the bone protruding in front and a deep depression behind. Flexion at the wrist was impossible on account of the projection of the scaphoid upward, in front of the radius. There was also great impairment of the use of the thumb and index-finger.

On April 4, 1899, Mr. R. was again etherized. I found, after a little manipulation, that the dislocation could not be reduced, if at all, without great force. It seemed that an operation was less likely to be injurious and much more likely to be successful. Accordingly, I prepared the surface and made an incision parallel to the outer border of the flexor carpi radialis tendon down to the scaphoid. I found its radial articular surface directed forward, having been rotated in dislocating. The curved point of an Allis dissector showed the articular surfaces free from adhesions, a large space between the scaphoid and semilunar bones, and strong adhesions between the lower part of the posterior surface of the scaphoid and the styloid process of the radius. These adhesions were broken by the dissector, and then, by extension, flexion, and pressure, the scaphoid slipped back into place. The cut ligament and skin were brought together with separate rows of sutures, and a dressing and splint applied. The wound healed without suppuration. Five weeks later everything pointed to a perfect result. A skiagraph shows the bone in place.

The account of the accident and the condition found at the operation show how the dislocation occurred. When the hand, palm down, struck the edge of the mats, it was hyper-extended so that the carpus was turned out of the joint anteriorly, but very obliquely, so obliquely that the junction of the scaphoid and semilunar bones rested on the wedge-shaped anterior border of the lower extremity of the radius. The two bones were then torn apart. The scaphoid was forced anteriorly and, as the posterior part of its semilunar articular surface was pressed upon most strongly, its radial articular surface was rotated forward. The semilunar and other carpal bones, being on the posterior surface of the wedge, slipped back into place.



FIG. 1.—Anterior dislocation of the carpal scaphoid bone.



FIG. 2.—Showing result five weeks after operation.

(II) A CASE OF CONGENITAL MALFORMATION OF THE CLAVICLE IN TWO CHILDREN SIMULATING AN ACCIDENTAL CONDITION IN THE MOTHER.

(II) My attention was recently called to a curious condition existing in one family, which is of interest from many points of view and quite worth recording. I purpose, however, to give only the known facts.

Mrs. C., aged forty-one, of slight build, the wife of a clergyman, gives me the following history: When about nine years old she fell and fractured her right collar-bone. Through neglect there is non-union. The sternal fragment measures two inches. When extended both fragments together measure four and a half inches, exactly the same as the sound one. When the shoulder is drawn in, there is a shortening of three-fourths of an inch. The ends at the point of fracture are slightly enlarged, especially that on the sternal side.

Mrs. C. has had three children. The first one died when fifteen months old. Nothing certain is known as to the condition of the clavicles, but no special attention was ever given or called to them.

The second child is now a girl of fifteen. When several months old her nurse accidentally discovered trouble with the right clavicle. She had never met with an accident and nothing had ever called attention to it. At the time this was discovered there was no soreness or inconvenience, nor had there ever been any. Examination now shows an apparently ununited fracture of the right collar-bone. The sternal fragment is exactly two inches long. When both fragments are in line they measure four inches, while the left clavicle measures four and a half inches. When the shoulder is drawn in there is one-half inch shortening. The ends about the apparent fracture are enlarged, especially the sternal one.

The third child is a boy of eight. His case has the same history as his sister's. A few weeks after birth the nurse accidentally discovered that there was trouble with his right clavicle, which had existed for some time. Examination shows an apparently ununited fracture of his right collar-bone. The sternal frag-

ment measures just two inches. When extended the bone measures four inches, the same as the sound one. One-half inch shortening can be produced. The sternal end is more clubbed than the other.

The mother says that she never met with any accident or received any injury during pregnancy; that she never thought that a child could inherit such a condition; that when the last child was born they never thought of examining the clavicles. The two children were born at natural labors, head presentations, and weighed about seven pounds. The doctor who attended her at her second confinement is dead, but the one who attended her at her third says there was nothing unusual about the labor, and that he never knew that there was any trouble with the collar-bone.

To sum up briefly, we have a mother, who has an ununited fracture of her right collar-bone, caused by accident in childhood. She has two living children, born after normal pregnancies, of natural size, in natural labors, who have never met with any accident, and have apparently ununited fractures of the collar-bone on the same side, in the same place, and with the same appearance as that of their mother.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 8, 1899.

The President, ANDREW J. MCCOSH, M.D., in the Chair.

RECOVERY FROM PISTOL SHOT WOUNDS OF THE INTESTINE AND STOMACH.

DR. GEORGE WOOLSEY presented a man, aged nineteen, who was admitted to Bellevue Hospital at 1.30 A.M., December 5, soon after having been shot in the abdomen with a 32-calibre pistol. He had severe pain and frequent vomiting, but no vomiting of blood, and there was but little if any shock. The wound of entrance was about midway between the axillary and scapular lines, and about one and a half inches above the iliac crest. The bullet could be felt beneath the skin, one inch to the left of the median line and just below the costal margin. An opening was made here, the bullet removed, and the track of exit explored. This showed it to be a penetrating wound, and, owing to the presence of gas and fæcal matter, a perforating wound also. Four or five hours after the accident, on the arrival of Dr. Woolsey, a six- or seven-inch incision, from a little below the ensiform cartilage, was made through the right rectus muscle one to one and a half inches from the median line, separating the fibres of the muscle. The incision a little to the right of the median line was chosen, because the course of the bullet indicated that most of the injury was on the right side, and the event proved the wisdom of this course, as the ascending colon was more easily reached.

There were two wounds of the ascending colon, two of the transverse colon, and two of the stomach. The wounds of the stomach were very close to the great curvature, one on the anterior and one on the posterior surface. The latter and one of the wounds of the transverse colon opened into the lesser peritoneal

sac, and were found and sutured through small openings (which were enlarged) in the gastro-colic ligament of the great omentum. All the wounds were sutured with Lembert sutures. The small intestine was examined from end to end, but no wounds were found.

Following the method used in a case with sixteen perforations (*ANNALS OF SURGERY*, April, 1896), an attempt was made to introduce powdered salol into the intestine through the wounds before suture, to act as an intestinal disinfectant before the bowels could be safely moved. It was, however, not found practicable. But little was introduced locally, and it was given afterwards by the mouth. Large quantities of a hot, normal salt solution were used to cleanse the cavity of the small amount of blood and stomach and intestinal contents found therein. Gauze drainage was introduced, as a matter of precaution, down to the foramen of Winslow, as the lesser peritoneal sac could not be so easily cleansed. During the next three nights the patient, suffering from thirst and a moderate degree of delirium tremens, got out of bed from one to four times a night, in the absence of the nurse, to search for a drink. Hence, in spite of the fact that the wound was sutured with silkworm gut through all layers with separate suture of the peritoneum and skin with catgut and silk respectively, it was not strange, on dressing the wound on the fourth day, to find that the sutures had torn through and the wound was gaping in the middle, where the intestines were exposed. Otherwise recovery was uneventful, though there was some rise of temperature for the first few days, but no symptoms of peritonitis. No food was given by the stomach for five or six days, rectal feeding being employed.

Twenty-four days after the first operation the surface was clean, and an operation was done to cure the hernia. The free peritoneal cavity was opened by prolonging the incision above and below. The intestines were found very adherent to the margins of the opening, and were separated with some difficulty. After passing the margins of the opening, so as to expose the rectus muscle, the wound was closed as before, omitting the separate cutaneous suture, and with the addition of three or four tension sutures of stout silk, which were required in bringing the edges together. In spite of some suppuration along the sutures, especially the tension sutures, the wound healed well

and gave a firm cicatrix, though between the latter and the median line the muscle-fibres seem to have atrophied, from section of the fine nerve-twigs supplying them. Its effect is to apparently widen the linea alba. There is no hernia. He was advised to wear an abdominal binder, and was discharged cured February 9, 1899.

In point of number of perforations it is far below the case in which there were sixteen perforations, but it is interesting in view of his recovery from the original injury, and in addition the delirium tremens and ventral hernia.

The prognosis was favorably affected by the wounds being confined to the large intestine and stomach, from which the extravasation of contents is less than from the small intestine, on account of the solid contents of the colon, and the fact that a small hole in the stomach is largely plugged by the mucosa. The principal extravasation in this case was from the stomach, and this was not great, in spite of the vomiting. Another point to be emphasized is that evisceration, gently done, with care that the bowels be kept warm and moist, did not materially add to the shock.

CARCINOMA OF THE PAROTID GLAND.

DR. C. K. BRIDGON presented a woman, twenty-five years of age, who, about seven years ago, noticed a very small lump over the left parotid gland, just in front of the ear. There was no pain, redness, nor inconvenience attending it. The swelling slowly but gradually increased in size for the next four years, until it was as large as a fair-sized lemon. In August, 1896, the tumor was excised, the pathological report being,—mixed sarcoma and carcinoma. The growth reappeared within a year, and in October, 1897, a small lump, the size of an almond, was removed. In March, 1898, it again appeared, and has grown much more rapidly than before. By November it had begun to involve the tissues behind the ear. There was never any pain until last December, when she began to have a continuous, dull, aching pain, which persisted up to the time of operation, and for the relief of which she came to the hospital. Her hearing has not been affected in any way. She has lost thirty pounds in weight during the last two years, but has felt perfectly well, and still weighs 270 pounds. She was admitted to the Presbyterian Hos-

pital January 10, 1899. At that time in the left parotid region there was a tumor two and a half by three inches in diameter, which occupied the space of the normal parotid gland. Tumor was partly in front and partly behind the ear, which was elevated by the growth beneath, and extended a short distance into the neck. The skin was very slightly adherent; of mottled, slightly purplish appearance. The tumor was somewhat movable on the deeper parts; was uneven, nodular, and of unequal consistence in different parts, there being two well-marked semifluctuating areas, one above and one below.

A complete extirpation of the diseased parotid gland was done, together with the external auditory canal, but leaving the auricle intact.

The after-progress of the case has been uneventful. The wound, except the upper part, healed by primary intention, all sutures being removed by the tenth day. Thirty days after operation the granulating area, being in good condition, was covered with a skin graft by Thiersch's method. Graft took well and was healed in three weeks. Paralysis of facial nerve complete.

Pathologist's Report.—Tumor three and a half inches by two and a half inches by two inches. One side covered by skin; somewhat nodular. On section a lobulated gray mass of moderate consistence.

Microscopic Examination.—Carcinoma. The cells are quite small, the alveoli in places very long and narrow. Very often plexiform.

LATE RESULT OF BASSINI'S OPERATION FOR INGUINAL HERNIA.

DR. WILLIAM B. COLEY showed a young man upon whom he had operated for inguinal hernia, by Bassini's method, six and one-half years before. The result was still perfect, although the patient had worn no truss since the operation. There were no signs of a recurrence and no atrophy of the testis.

Dr. Coley said the only modification he had made in the technique of Bassini's operation was the substitution of chromicized kangaroo tendon for silk. He had recently learned that since 1892 Bassini had given up the use of silk entirely, using chromicized catgut.

MULTIPLE MELANOTIC SARCOMA(?).

DR. A. B. JOHNSON presented a man, fifty-nine years old, a farmer, apparently well nourished, who had always led an out-of-door life, and had never used alcohol to excess. He was in good health until March, 1897, when he noticed a small spot on the right side of the back, over the lower end of the scapula. In appearance it resembled a wart. It was removed a month later, and pronounced by the pathologist a carcinoma.

In July, 1898, about a year afterwards, a lump appeared in the left breast, which rapidly increased in size. That was removed in October of that year, and pronounced a melanotic sarcoma. In July, 1898, he noticed a small lump in the right axilla, which has since increased in size: it measured about three inches in each diameter; it was not painful and freely movable. It was removed on February 10, 1899. An incision, six inches long, was made just anterior to the axillary fold, and the tumor, together with the adjoining tissues, dissected out. It was not adherent to the muscular structures. Six or eight smaller tumors, which seemed to be enlarged lymphatic glands, were also removed, the entire contents of the axilla being taken out. The wound healed without complications.

The man has moderate enlargement of the liver, although there are no symptoms particularly referable to that organ, excepting a slightly yellowish tinge to the conjunctiva. He has no symptoms referable to the stomach or any of the other internal organs. He has lost some flesh and strength.

The pathologist, to whom the tumor removed from the axilla was submitted for examination, reports that it was deeply pigmented, as though rubbed with charcoal. Upon section, a somewhat unusual structure was revealed. The principal part of it was distinctly alveolar in character, and in many of the alveoli it was difficult to distinguish any stroma between the individual cells, the structure resembling that of a carcinoma, but, in addition, there was an enormous amount of pigment scattered throughout the tumor. It was impossible to say whether it was a carcinoma or a melanotic sarcoma.

DR. COLEY said that in malignant disease of the melanotic type the prognosis was extremely bad, especially where the growths are multiple. The speaker said that in sixteen cases of

this variety, which had come under his observation, there was comparatively early involvement of the liver and abdominal organs. He knew of only two cases of permanent recovery following operation, the patients having thus far remained well for nine and ten years respectively.

DR. ROBERT ABBE said that while this type of malignant disease was extremely fatal, it was not absolutely so, and, unless the growths were multiple, the patient should receive the benefit of the doubt and be operated on. The speaker said that four years ago he saw a patient with a tumor of the right breast, three inches long and one inch wide, which was reported to be a typical melanotic epithelioma of the blue-black type. It was widely excised, and thus far no recurrence has taken place.

LAMINECTOMY FOR DISLOCATION OF THE SPINE.

DR. JOHNSON presented a man, thirty-two years of age, who had enjoyed good health until the 6th of last July, when he fell from a cherry-tree, striking upon his buttocks. The injury received produced almost complete loss of motion in both lower extremities, anæsthesia of the genitals, the inner surfaces of the thighs, partial anæsthesia of the outer surfaces of the thighs and of the legs, with complete paralysis of the bladder and loss of control of the rectum. When the reporter first saw this patient, three months later, he had regained some muscular power in the lower extremities, so that he was able with assistance to walk a few steps. He thought that the anæsthesia was slightly improved; it was, however, well marked, and no urine had been passed since the accident, except by means of a catheter. He had no control over his rectum. In the region of the lower dorsal spine there was a marked kyphosis, corresponding to the spine of the first lumbar vertebra. The distance between the last dorsal spine and the first lumbar spine was greater than normal. Palpation on either side of the spine showed the presence of two sharp, bony prominences, corresponding to the articular processes of the first lumbar vertebra. The first lumbar vertebra appeared to be dislocated backward. The patient was somewhat emaciated and in poor condition generally, and it was decided that an operation might give him some relief. A vertical straight incision, six inches in length, was made over the spines of the vertebræ, with its centre over the

space between the last dorsal and the first lumbar spine. The muscles were stripped away upon either side from the spines and laminae, and the bleeding checked by means of gauze packing; few ligatures were applied. After the separation of the muscles the spines and arches of the last dorsal and of the first and second lumbar vertebrae were removed with rongeur forceps. It became evident that the arch of the last dorsal was pressing forward upon the dura. Underneath the arches of the first and second lumbar, also compressing the dura in a forward direction, was a dense mass of new connective tissue. No evidences of fracture were found. By raising the dura and exploring the anterior wall of the spinal canal with the finger and with blunt instruments a bony ridge could be felt, which appeared to be the upper border of the body of the first lumbar vertebra. The dura appeared to be markedly distended; it was punctured, and a stream of clear cerebro-spinal fluid escaped under some tension. Inspection of the cord showed nothing beyond an apparent flattening. The wound in the dura was closed, as well as the wound in the remaining soft parts, by means of sutures. Primary union occurred throughout.

After the operation the patient complained of a good deal of pain in his legs. Within a week he began to urinate voluntarily, and has now regained complete control over his bladder and rectum. He walks so well that he has been enabled to resume his ordinary occupation. The anæsthesia has almost entirely disappeared, and his general health is excellent.

NECROSIS OF ENTIRE TEMPORAL BONE.

DR. BERN B. GALLAUDET related the following case: A man, forty-eight years of age, came under his observation in November, 1897, with a history of having suffered from right-sided otitis media, which was treated by incision of the membrana tympani. No cure resulted, and the inflammation became chronic, with continuous discharge, pain, and deafness, but general health remained good until July, 1897, when increase in pain and a mild septicæmic condition developed, on account of which the mastoid was opened and drained. A month later this opening was enlarged; but the process still continued, and facial paralysis of the same side developed. Both general and local symptoms grew

slowly worse for the next three months. When seen, in November, 1897, his general condition was one of septicæmia. *Locally*, from an opening behind the right ear, which led to dead bone, and from the meatus, there was a seropurulent discharge of rather bad odor. Overlying and surrounding soft parts were somewhat red and brawny. No tenderness, but constant pain above external auditory meatus.

After flaps had been raised backward and upward and forward, the entire external ear had been turned forward by cutting entirely across the cartilaginous meatus. There was revealed a very extensive area of necrosis, quite soft, and showing a seropurulent exudation not only on the surface but from the substance of the bone every time a piece was removed. This area was entirely removed, and involved the *whole temporal bone*, except the zygomatic process, the articular portion of the glenoid fossa, and just the tip of the mastoid process. It also involved the parietal bone for about a square inch, surrounding and including its postero-inferior angle, and a like area of the adjacent portion of the occipital bone, thus, on removal, exposing the posterior surface of the lateral sinus and a portion of the dura mater of the cerebellum. No especial difficulty was found in removing the necrotic bone, which came away readily enough in fragments with the use of rongeurs, thumb-forceps, and scissors. The last piece removed was the apex of the petrous portion of the temporal bone, readily recognized by the carotid canal, and, it must be confessed, that as it came away a sort of breathless interest was aroused as to what might be the behavior of the internal carotid artery. However, no damage was done to the vessel, even when the thin scale of bone lying underneath the artery was also extracted. The dura mater was greatly thickened everywhere, and in two places seemed soft and fluctuating, but on aspiration nothing was found. The flaps were restored in place and partially sutured, and gauze packing inserted.

Post-Operative Condition.—Recovery from ether satisfactory, as was also the general condition for a month following; no temperature; no pain; appetite good, etc. The wound, however, did not do well under any application, although some granulation tissue did form way down around the internal carotid artery. It seemed as if the process of repair could not take place, owing to the density of the tissues from which it must start,—

viz., dura mater and sclerosed bone. It was interesting to note, at the dressings, the extent to which repair seemed possible,—viz., a thick covering of white fibrin on the dura and a few isolated bunches of real granulation tissue dotted here and there over what was really a white expanse. Furthermore, there was always a serous discharge with a foul odor. At the end of a month a kind of hectic condition developed, a mixture of chronic septicæmia and toxæmia, with occasional mild delirium, and death occurred on the fortieth day after the operation.

SARCOMA OF THE UPPER JAW.

DR. GALLAUDET also related the history of a man, sixty years old, who came under his observation for the first time in December, 1896, with a diagnosis of sarcoma, which had been made by Dr. J. Wright, from a portion removed through the nares by Dr. Brandegee, under whose care he had been. The man was ill nourished, very nervous and excitable, and with marked morphine habit. Locally nothing showed externally but a slightly bulging eyeball, with vision unimpaired. By Ferguson's incision and flap the entire growth and left superior maxilla were removed, preceded by ligation of external carotid artery immediately above the superior thyroid branch. No complications occurred during the removal, after which the flap was restored in place and sutured, the cavity being packed through the mouth. The post-operative course, locally, presented nothing of especial interest. Primary union occurred along the line of sutures, the cavity filled up satisfactorily, leaving only a very small depression on the face, and there had been no recurrence up to September, 1898. The patient's general condition, however, took a more unusual course. On the day after the operation complete hemiplegia of the right side developed, and persisted for three or four months, accompanied by a more or less acute mania, after which time both the hemiplegia and mania gradually subsided, until last under observation, in April, 1898, when the lower extremity was functionally normal and the upper extremity nearly so, except for general weakness and some contraction of fingers and elbow, and the mania had become chronic melancholia.

To account for this hemiplegia is difficult. The circulatory system and organs were perfectly normal at the time of the oper-

ation, and the anæsthetization (ether) was smooth and without complication. At the end of three weeks Dr. Peterson was called upon for his opinion, which was that probably an embolus had been broken off from the lower end of the clot in the external carotid artery below the ligature, and had been carried up into the internal carotid, and thence to the brain. A possible alternative, very delicately suggested, was ligation of the internal carotid artery by mistake for the external. As the ligature of the artery was above the site of the superior thyroid branch, it would seem that this position of the ligature should have been a sufficient safeguard against the formation of a clot long enough to reach the bifurcation of the common carotid. Against the other explanation,—viz., ligation, by mistake, of the internal carotid,—there is, of course, nothing to bring forward except a feeling of positive assurance, on the part of the reporter, that such a mistake was not made. Ordinary pressure paralysis, coming on after anæsthesia, would not account for the condition, because there was absolutely no pressure exerted anywhere on either extremity during the operation. At length, during the following month, January, 1897, after a fair amount of research, two articles were found which appeared to throw a little light on the subject, one by Dr. H. J. Garrigues, in the *American Journal of the Medical Sciences* for January, 1897; the other a report by Casse in the *Bulletin of the Royal Academy of Medicine of Belgium*, 1897, No. 2.

In these a number of cases were given of post-anæsthetic paralysis of either one or both extremities, and which were called "central anæsthesia paralysis," the primary cause being the anæsthetic, while various secondary causes—excited by the anæsthetic—are mentioned as possible factors,—viz., cerebral emboli, apoplexy, primary cerebral softening, and toxæmia. Among the symptoms mentioned, which were similar to those of the present case, were acute mania and a more or less complete recovery from the paralyses. Still later were noted the following: *ANNALS OF SURGERY*, February, 1897, a review, by H. P. de Forrest, of Krumm's monograph on narcosis paralysis, in which it is stated that "central narcosis paralyses are so rare as to be of little practical importance"; *ANNALS OF SURGERY*, June, 1897, a letter by the same writer, reporting a case of "central narcosis paralysis"; a report of two cases of the same in the *Centralblatt für Chirurgie*, No. 35, September, 1898. In all the articles mentioned, besides

that of Krumm, a point is made of the comparative rarity of the occurrence. From the preceding, it has been deemed justifiable not only to call this case one of central anæsthesia paralysis, but to report it.

DR. ROBERT ABBE said in regard to sarcoma of the superior maxilla, if the bone is thoroughly removed, as can readily be done, a recurrence, in the great majority of cases, is not apt to take place for a long time,—even for many years. Preliminary ligation of the external carotid renders the operation comparatively bloodless, and, together with a preliminary tracheotomy, adds to the ease of its performance.

Although recent researches would indicate that ligation of the external carotid, with the idea of retarding the growth of tumors in this region, was of minor value; it had always seemed to him to be an important measure, because the vitality of the tumor depended so largely on this artery. In one case which came under his observation four years ago, the whole face bulged out with an enormous sarcoma, which involved the antrum and maxilla. In that case he ligated both external carotids simultaneously, which produced a marked temporary effect on the nutrition of the face. For a number of hours subsequent to the ligation the labial regions and cheeks about the nostrils were quite anæmic, and a sense of numbness and tightness of the face was complained of. These symptoms gradually disappeared within a few days.

Dr. Abbe said that in one case of pulsating angiona of the superior maxilla, where complete removal was not deemed advisable, he ligated both external carotids simultaneously. The tumor is now—eighteen months after operation—about one-half the size it was previous to the operation. In another of his cases the patient has remained well over three years.

DR. C. K. BRIDDON referred to a case where he had resorted to ligation of the common carotid with the idea of retarding the growth of a large, pulsating tumor of the orbit, which caused a protrusion of the eyeball. The patient was a colored woman. She suffered from hemiplegia after the operation, and was found dead in bed on the fourteenth day. At the autopsy, the usual conservative processes were found in both the internal and external carotids, while the tumor in the orbit had entirely disappeared. Of course, it was aneurismal.

Dr. Briddon said that, many years ago, the ligation of arteries for the control of malignant growths was a method of treatment which prevailed to a considerable extent. It was found that this would produce a diminution in the size of the tumor until collateral circulation was established, and then the tumor grew with the same rapidity as before.

DR. JOHNSON agreed with the statement that in malignant disease of the upper jaw an operation will oftentimes confer immunity for a considerable period. In one case which the speaker had in mind there were several recurrences, following one another at increasing intervals. After the fourth recurrence the growth was again removed, and the patient has now been free from all signs of further recurrence for six years.

Temporary ligation of the external carotid, the vessel being compressed between a thick ligature and the finger of an assistant during the operation and removed when the operation is finished, had proved a satisfactory measure in the speaker's experience, not only in cases of sarcoma of the upper jaw but also in large tumors of the lower jaw, where one-half or more of the jaw had to be removed. The speaker said that in those cases where the tumor was situated in the neighborhood of the angle of the eye or occupied the orbit, he was not inclined to believe that ligation of the external carotid would effectually prevent bleeding. He had seen one death result from thrombosis extending up the internal carotid into the cerebral arteries in a case where a malignant growth involved the common carotid, necessitating ligation of both the internal and external carotids, with excision of a portion of the common carotid as well as of the internal jugular vein. Death occurred in twenty-four hours.

DR. W. B. COLEY said he had resorted to ligation of the external carotid in four cases of malignant disease of the face; all the patients recovered from the operation, and the growth of the tumor was somewhat retarded, but only temporarily. The speaker called attention to the fact that ligation of the external carotid is attended with a certain amount of risk: two deaths have resulted from it in the practice of Watson Cheyne, one directly and one indirectly. There is danger of softening and secondary hæmorrhage if the wound does not heal primarily. If the ligation is done in connection with the removal of a tumor of the head or

face, it should preferably precede the major operation by a week or two.

DR. PARKER SYMS said he had never had occasion to tie the external carotid as a preliminary to removal of the superior maxilla, and he was rather surprised to hear the operation advocated as an adjunct to the removal of the superior maxilla. In a number of instances where he had removed this bone, as well as in others where he had seen it done, tying the external carotid was entirely unnecessary. If the operation is done deliberately, step by step, the hæmorrhage should be very insignificant.

Dr. Syms said he thought it quite possible that the hemiplegia in Dr. Gallaudet's case resulted from embolism; possibly, however, it was due to some injury inflicted through the base of the skull. The speaker said he had recently heard of a case where an operation for the removal of hypertrophied turbinated bones resulted fatally, death occurring shortly afterwards from undoubted intracranial hæmorrhage.

SUPPURATIVE CHOLECYSTITIS AND RUPTURE.

DR. GALLAUDET reported the case of a man, aged fifty-three years, who first came under his observation in November, 1897, having been transferred from the medical to the surgical wards at Bellevue Hospital. He had had a general septic temperature and pulse for three weeks, with pain over the region of the gall-bladder. For about two days previous to the transfer his symptoms had grown worse, and a fluctuating tumor had appeared under the rib cartilages of the right side. Immediately after the transfer a free incision was made over and into the swelling, which evacuated a large quantity of bile mixed with pus, and revealed a large cavity with a definite wall of soft tissue, which could be mapped out by palpation as extending in all directions without a break. Inferiorly and posteriorly the wall was thin enough to permit recognition, both by touch and sight, of the colon. Into the deepest part of this cavity, up under the liver, was projecting the torn fundus of the gall-bladder, from which came bile and pus. The walls of the gall-bladder were red and swollen. As it was impossible to bring the gall-bladder up into the wound, and as the patient's general condition was very poor, nothing more was done beyond packing the cavity and narrowing the incision above and below. One suture was also placed in the gall-bladder

simply to lessen the size of the rupture. Care was also taken during the evacuation of the fluid not to allow its too rapid exit. Recovery from ether was satisfactory, and during four days his general condition greatly improved. He had no pain nor temperature; his pulse was normal, and his bowels were fairly regular, the color of the movements being also normal. There was free discharge of bile and pus from the wound, which was irrigated and dressed once or twice daily. On the fifth day, however, his general condition began to grow worse, some rise of temperature, never very high, irregular pulse, and general apathy developed, and death came on the eighth day after operation. The autopsy was necessarily limited to the cavity above mentioned, since permission to make a general autopsy was refused. Hence liver and gall-bladder could not be examined. The cavity into which the gall-bladder had ruptured was satisfactorily made out, and was found to consist of a regular sac of fibrin, beginning at just above and embracing the fundus of the gall-bladder, and extending thence, like a balloon downward, forward, and laterally, and capable of holding over a pint of fluid. The surroundings of the sac, to which it was adherent, were the liver, duodenum, stomach, hepatic flexure of colon, and abdominal parietes. The gall-bladder had manifestly been walled off from the general peritoneum by a *local fibrinous peritonitis*. There was no peritonitis outside the limits of this sac.

This sac-like formation of fibrin around the gall-bladder appears somewhat unusual, as the reporter did not recollect to have read any account of a similar condition, although this is not at all conclusive, as nothing that can be called research into the literature has been made. Verbal inquiry of a few members of this society has also proved fruitless, except as regards Dr. Ellsworth Eliot, who said he knew of a similar case.

SEROUS CHOLECYSTITIS AND SUPPURATIVE CHOLANGEITIS.

DR. GALLAUDET reported the case of a man, aged twenty-four years, who first came under his observation at Bellevue Hospital, September 22, 1898. He was a soldier, and had first taken ill in Cuba, August 11, with chills, fever, and sweating. These conditions continued also at Montauk Point until September 20, when he entered the hospital because of severe abdominal pains, jaun-

dice, vomiting, and constipation. Examination revealed high temperature and jaundice, with marked pain and tenderness over the region of the gall-bladder. No tumor. After twenty-four hours under conservative treatment without improvement, an incision was made over the gall-bladder, which revealed that structure swollen, tense, and red. Incision into it evacuated about three or four ounces of white fluid resembling glycerine. As this condition seemed hardly sufficient to account for the symptoms, the abdominal incision was enlarged sufficiently to inspect and palpate the adjacent part of the liver, the bile-duct, and the vermiform appendix, all of which appeared normal. On palpating the gall-bladder, however, there was found, what had been overlooked at the first incision, a complete fibrinous sac, just like the one in the previous case, but much smaller and investing the gall-bladder, without adhering to it, right up to its neck. The fundus of this sac had been cut into by the incision. The cavity of the gall-bladder was then inspected, and some blood was found coming out. Cholecystostomy was then performed and a gauze drain inserted.

For forty-eight hours thereafter his temperature was over 101° F.; there was vomiting of bile, continuance of pain, and one or two small clay-colored stools, together with a copious discharge of bile from the wound. Enemata given and stomach washed out. On the third day marked improvement was noted, temperature normal, no pain nor vomiting, and in the bile from the wound was found quite a little pus. From this time on his recovery was uninterrupted, and by November 15 the patient was up and about, feeling perfectly well, and with normal stools. The biliary fistula, however, still discharged considerable bile, but without pus, which had ceased to flow a week or two previous. On November 30 the discharge of bile had greatly diminished, the fistula was merely a pinhole opening, and at his urgent request the patient was discharged, with instructions to return, which have not been followed.

The following may be regarded as a probable sequence of events in this case: Suppurative cholangitis succeeded the "chills and fever," and, extending down the lumen of the larger ducts, caused a blocking of the cystic duct. This blocking resulted in hydrops of the gall-bladder, which, in its turn, acted as a predisposing cause to the severe cholecystitis, the exudation of

which, mingled with the hydrops, formed the glycerine-like fluid which was evacuated. Finally the cholecystitis set up the circumferential fibrinous peritonitis which formed the sac. As to the post-operative condition, it seems clear that continuance of the symptoms for the first two days was due to the fact that, for some reason or other, the pus remained pent up in the bile-channels, its exit on the third day being accompanied by cessation of symptoms. It is not clear why the pus did not accompany the flow of bile which took place on the first day.

ABSCCESS OF PANCREAS.

DR. GALLAUDET reported the case of a man, aged thirty-seven years, who first came under his observation in September, 1897. For a period of two months there had been present continuously severe epigastric pain of sudden onset, more or less constipation, loss of appetite, flesh, and strength. No vomiting.

Examination showed marked emaciation; temperature, 100° F.; pulse, 90. No fatty matter found in pus nor sugar in urine. In the epigastrium was a tumor, size of a small apple, hard and tender to the touch, immovable, and apparently adherent to the anterior abdominal wall. No signs of aneurism could be made out. A vertical incision, three inches long, over the tumor and carried down to it, showed a normal abdominal wall and fully exposed the tumor. On retracting the edges of the incision strong adhesions were found, between the swelling and posterior surface of the abdominal wall, extending above and below and on both sides of the growth, thus completely walling off the peritoneal cavity. An incision into the tumor was then made, and evacuated a quantity of thick, greenish pus. Sponging revealed the fact that the pus was exuding from various small foci. The intervening tissue was soft and could be broken down by the finger. The incision was then carried deeper into the abscess and more tissue broken down. More pus came away, and as the finger could distinctly feel the aorta pulsating directly beneath it, no further incisions were made, and the cavity was packed with gauze. His general condition improved rapidly thereafter, and the wound healed by granulation, the pus of the original inflammation ceasing to appear after the third or fourth day. Cicatrization was complete at the end of six weeks. About three weeks after the incision a calculus, rough, rounded, and about half an

inch in diameter, was removed from the bottom of the wound. From the preceding the diagnosis of abscess of pancreas seems correct, especially when the presence of the calculus is considered.

During the past ten years about ninety cases of acute infectious pancreatitis (including suppurative and gangrenous) have been recorded by Page (*Centralblatt für Chirurgie*, 1898). Of these only about one-half belong to the past eight years. "The prognosis of pancreatic abscess," according to Richardson, "is distinctly bad. In the most acute cases death occurs in a few days." In the present case the favorable result is largely, if not almost entirely, due to the adhesions to the abdominal wall. As the incision was about midway between tip of ensiform cartilage and umbilicus, the pancreas became adherent, probably by growing forward, between the greater curvature of the stomach and the upper border of the transverse colon, thus massing together and eventually obliterating four layers of peritoneum, one, its own layer, the two layers passing from stomach over colon (gastro-colic ligament), and the parietal layer.

CARCINOMA OF PANCREAS.

DR. GALLAUDET also reported the case of a man, aged twenty-eight years, who first came under his observation at Bellevue Hospital in August, 1894. Two months before a small lump was noticed in the right side of his abdomen, which had grown rapidly since then, accompanied by symptoms of steadily increasing intestinal obstruction, and marked loss of flesh and strength. There was no especial pain nor symptoms indicative of obstruction of the bile-duct. Five years before he had been squeezed across the abdomen while coupling cars. Two years before he was infected by syphilis. Six months before, his right testicle had been removed for adenosarcoma. Examination showed a condition of general emaciation, with dilatation of stomach, and persistent vomiting and absolute constipation for three days. A hard, painless, somewhat movable tumor, about two and a half inches in diameter, was present above and to the right of the umbilicus and about half-way between it and the border of the right costal cartilages, over which the abdominal wall was freely movable. A vertical incision over tumor exposed the peritoneal cavity with the great omentum covering the tumor. This was pushed up and revealed the tumor still covered by lower layer of transverse mesocolon.

This was bluntly split and pushed aside, when the tumor appeared as a dark-red mass, size of a lady-apple, elastic, firmly adherent to posterior abdominal wall, and completely obscuring the descending portion of the duodenum. It appeared to shade off to the left with a marked curve. Aspiration and careful incision into the growth brought blood, and indicated by the feel of the cut a rather dense structure. Vascularity marked. Pads were placed *in situ*, the colon drawn down, and the gall-bladder palpated. It was apparently normal. Gastro-enterostomy was decided upon, but the patient's general condition became critical, requiring infusion, etc., so nothing more was done save to isolate the surface of the tumor at the bottom of the wound and introduce gauze packing. A few days later, the patient having improved sufficiently to warrant it, *anterior* gastro-enterostomy was performed, the anæsthetic being cocaine, and the method that of simple suturing according to the plan described by Abbe. About a drachm of a 4-per-cent. solution of cocaine hydrochlorate was used. There was nothing especial to note during the operation except it was found that, owing to the lax condition of the gastro-colic ligament and unusual thinness of the transverse mesocolon, these structures could be readily split and the jejunum drawn up *behind* the transverse colon. It was also interesting to note the diminishing sensibility of the tissues from the skin down through the muscles, and also the apparently entire absence of ordinary sensibility in the stomach and intestines as the incisions were made into them. Suturing the abdominal wound, as might be expected, caused more pain than the incision. These facts were elicited by direct questioning of the patient from time to time, who was calm and intelligent throughout, except at the end when general condition was poor. The patient lived for forty-eight hours and took nourishment without vomiting, but gradually sank into collapse and died. Autopsy showed a tumor involving the head and body of the pancreas and pressing on the duodenum, to which it was adherent sufficiently to obliterate almost its lumen. Curiously enough, neither the narrowing of the duodenum nor the tumor itself seemed to affect the lumen of the bile-duct. No other lesions were found. The gastro-enterostomy adhesion was complete. Microscope showed scirrhus carcinoma. As usually stated, the determining symptoms of carcinoma of the pancreas are those indicative of obstruction of the bile-duct, and the advice

is given, in those cases in which removal of the growth is impossible, to do cholecystenterostomy. In the present case the determining symptoms were those of intestinal obstruction, without special involvement of the bile-duct, and gastro-enterostomy seemed to afford at least temporary relief.

PENETRATING STAB-WOUND OF THORAX, DIAPHRAGM, AND STOMACH.

DR. GALLAUDET reported the case of a man, aged twenty-five years, who first came under his observation, at Bellevue Hospital, in September, 1897, about six hours after receipt of a wound, which was self-inflicted with a long carving-knife. Examination showed considerable shock, some tympanites of abdomen, and a wound about one inch long in the fifth intercostal space, just mesial to the mammary line, from which oozed a slight amount of serous-looking fluid with an odor suggesting that of stomach or intestinal contents. There had been considerable hæmorrhage from the wound at first. On enlarging the thoracic wound a large quantity of semisolid stomach contents gushed out. The wound was then packed and the peritoneal cavity opened by an incision parallel with the border of the left costal cartilages. In the cavity was more semidigested food, which seemed to increase in amount with every inspiration, and in spite of preliminary irrigation.

Wide retraction and inspection showed semidigested food coming from the stomach and through the diaphragm. On introducing the hand a finger could be inserted into a hole in the diaphragm and feel the impact of the heart within the pericardium. The hole in the diaphragm was plugged with gauze and that in the stomach temporarily held until irrigation cleared the field, and disclosed the "hole" to be a wound one inch long of the anterior wall of the stomach, running downward and forward from just below the œsophagus. The fingers of both hands were required to hold the edges of this wound together and prevent further extravasation of food, while three interrupted sutures were placed by the house-surgeon, running through all the coats of the stomach. This procedure remedied the out-flow of contents and allowed complete closure of wound by regular Lembert sutures.

The gauze packing was then removed from both the thoracic wound and that in the diaphragm, and the diaphragm was

pushed down into the upper part of the abdominal wound and held there by the fingers of one hand introduced through the thoracic wound. In this position the wound in the diaphragm, fully one inch and a half long, was closed with interrupted silk sutures. Of the fingers in the thorax two were also in the pericardium, in the wall of which could be felt a ragged tear, while directly on the fingers the heart could be felt beating during the placing of the sutures. After cleansing and closing the abdomen, the condition of the patient did not warrant exploration of the thorax and suturing the pericardium. The thoracic wound was accordingly packed, the gauze extending a little into the pericardium. He made a good recovery from ether, but life continued only for ten hours, death being due to shock, as the autopsy showed no peritonitis, no pleurisy, and no giving way of any of the sutures. The autopsy also showed the tear in the pericardium, that the heart and lungs were not wounded, and that considerable stomach contents were still in the pleural cavity, although the latter had been irrigated, at the close of the operation, through the original wound and a large drainage-tube placed in a counter-opening made in the eighth intercostal space.

From the various data obtained at the operation and the autopsy, it was evident that the direction of the knife must have been from above obliquely downward and backward, thus causing it to cut the fifth intercostal space, traverse the pleura, pierce the pericardium and diaphragm, and finally to enter the stomach. This was found, later from witnesses, to be the fact, and an explanation was also given of the enormous quantity of extravasated food. It seemed that the patient had been on a prolonged spree the night before, on the lower east side of the town, visiting many places and eating and drinking freely. Finally, in the early morning, he became violently remorseful, it appeared, and seizing a large carving-knife which was on a table, he stood up, raised the knife in both hands, with the point downward towards his heart, and plunged it into his body up to the handle.

PERFORATING ULCER OF THE DUODENUM.

DR. JOHN F. ERDMANN showed two fresh specimens of perforating ulcers of the third portion of the duodenum. Both of these cases had come under his observation within four days. The first case was that of an Italian laborer, thirty years old, who

gave no previous history of any digestive troubles. On February 10 he was suddenly seized with an attack of pain in the abdomen. Dr. Erdmann operated thirty-six hours later, and found a general septic peritonitis, with perforation of the anterior wall of the duodenum.

The second patient was also a man, forty years old, strong and robust, without any history of previous disease. He was seized with a sharp pain in the abdomen at six o'clock in the evening. The true condition of affairs was not recognized until the following afternoon, when an operation disclosed a septic peritonitis and a perforation in the anterior duodenal wall, as in the first case.

In both his cases there was neither blood nor food in the peritoneal cavity. In the second case the cavity contained a yellowish fluid.

Dr. McCOSH said he had seen two cases of perforating duodenal ulcers within the past month, the last one within a week. One of the patients had been in the medical wards of the hospital for two weeks, when he suddenly developed acute abdominal pain. Upon operating, about two quarts of blood were found in the abdominal cavity and about half that quantity in the stomach. Investigation showed a perforating ulcer of the first part of the duodenum, on its inner wall, the perforation being about the size of a fifty-cent piece. Forty-eight hours later, Dr. McCosh said, he was called to see another similar case. The patient, a man, was practically moribund, and an operation was deemed inadvisable. The man died a few hours later, and at the autopsy a perforating ulcer of the inner wall of the duodenum, about the size of a nickel five-cent piece, was found.

EDITORIAL ARTICLE.

RUTKOWSKI ON A NEW PLASTIC OPERATION FOR EXSTROPHY OF THE BLADDER.¹

THE plastic repair of congenital defects of the urinary bladder is confined entirely to cases of exstrophy. The operation devised by Maydl seems not to answer the purpose for which it was intended. Its shortcomings depend upon the inadequacy of the plastic material used. Skin-flaps, single or double, are not well adapted to form a part of the bladder wall. The epidermis acts as a foreign body in the bladder, and, as it contains no muscular fibres and cannot participate in the contraction of the rest of the bladder wall, it has a function-disturbing effect. The operation presents many difficulties which stand in the way of its coming into general use. Primary healing, so essential for a successful result, is rarely secured. On account of this secondary operations must be repeatedly performed, which prolong the treatment and tax the patience of the subject and the surgeon. It is easy to understand why the plastic bladder operations are applicable only to cases of exstrophy. After excision of a part of the bladder wall for pathological changes, tuberculosis, neoplasms, etc., the repairing of the defect by skin-flaps is quite out of the question, for here all of the difficulties of such an operation are even much greater than in the treatment of congenital defects. Maydl's recent operation of implanting the ureters, together with a part of the bladder wall, into the colon cannot be regarded as a satisfactory substitute for the plastic operation. The results of this operation, however, up to the present time, have been fairly en-

¹ Zur Methode der Harnblasenplastik; Max Rutkowski, Centralblatt für Chirurgie, No. 16, 1899.

couraging. As has been shown in his last twenty cases, it is possible to prevent kidney infection by the methods which he has adopted. This operation presents the objection that extirpation of the bladder is required, whereas that organ shows no structural defect except the congenital anterior opening. This operation is, furthermore, not acceptable to the conservative tendency of modern surgery.

A question of importance in the plastic operations for bladder exstrophy is the construction of a water-tight sphincter. Judging from what has been accomplished in other organs in this line, it may safely be assumed that the surgery of the future will make it possible here. On the other hand, there are cases of tuberculosis and neoplasms of the bladder, in which not only part of the bladder wall must be removed but also the ends of the ureters. In these cases implantation of the ureter into the bowel is about the best that can be done. This operation, as the clinical and experimental studies of Giordano have shown, presents the great danger of kidney infection. To overcome this danger, surgeons have isolated that portion of the bowel into which the implantation is made or constructed the opening of the ureter in some way so as to prevent the entrance of infection. To the first method belongs the operation of Mauclaire. This operation consists in dividing the bowel at the junction of the sigmoid flexure and the rectum. The sigmoid opening is implanted as an artificial anus into the inguinal region or brought out through the perineum; the upper end of the rectum is closed and the ureters implanted therein. This operation was performed upon a man first by Gersuny (*Wiener klinische Wochenschrift*, 1898, No. 43), after dividing the rectum from the flexure he closed the latter, and implanted in it the ureters with a part of the bladder wall, thereby forming a new bladder. The end of the flexure he carried down through Douglas's pouch and through the sphincter, where it was sutured. This operation gave an artificial bladder and an artificial anus, with a good sphincter. Hochenegg implanted the

ureters into an isolated segment of bowel. All of these modifications seem to simply complicate and render more difficult and hazardous the simple operation of implanting the ureters into the bowel, which operation has been demonstrated to be fraught with little danger. Krynski (*Przegląd lekarski*, 1895, No. 46-50) endeavored, by the peculiar method of implantation, to prevent secondary kidney infection. He recommended that the implantation be made as obliquely as possible by means of a valve-like flap in the intestinal wall. However, none of these operations can take the place of the plastic operation.

The success of a bladderplasty must depend largely upon the quality of the material employed. The flaps employed must possess certain properties. They must be provided with mucous membrane and muscularis, and be of such a structure that primary healing can be expected to take place. There must be sufficient of the material to make a flap of the required size. All of these conditions are found in a flap composed of intestinal wall and attached by a pedicle of mesentery. In this is the ideal material for a bladderplasty. The questions which arise are as to whether the danger of the operation is not too great, and whether the difficulties of the procedure do not render the chances for success very small. The present status of surgical technique dispenses of all of the objections. The technique of resection of the intestine and suture of the same is in such an advanced state of perfection that such an operation done upon the healthy intestine is no longer regarded as dangerous. Tizzoni and Poggi were the first to demonstrate the feasibility of this operation. In 1889, before the Sixth Italian Surgical Congress they showed a dog, in which, after total excision of the urinary bladder, they had constructed a new bladder from a segment of intestine. The operation was done in two stages. At the first operation the segment of intestine was isolated, and the gut repaired. At the second operation the lower end of the isolated segment was sutured to the neck of the extirpated bladder and into its upper end the

ureters were implanted. An attempt to do the operation in one stage was a failure, the dog upon which this was attempted surviving the operation only eight days.

The principle of Rutkowski's operation is quite different from that of Tizzoni and Poggi. It occurred to him to use the intestinal wall as a flap to cover in the defect in the bladder. This operation he successfully performed on May 5, 1898, upon a boy twelve years of age. The patient was well-nourished and strong. Just above the symphysis was an opening two and a half centimetres in diameter, through which protruded a tumor the size of a pigeon's egg. The tumor was of a bright red color and presented numerous irregularities and folds over its surface. It bled easily. Pressure upon the abdomen materially increased its size. Urine flowed from the opening through which the tumor protruded. Along the lateral borders of the two recti muscles were scars ten centimetres long, which extended down to the level of the symphysis. Below the opening hung the penis as a short, misformed organ. On the dorsal surface was a longitudinal cicatrix. There was a narrow urethral canal. The skin of the small scrotum and of the inner part of the thighs was eczematous. In the sacral region were two parabolic scars, which corresponded with the sacro-iliac synchondroses. The above-mentioned tumor could be easily reduced. The finger introduced through the opening entered a cavity about the size of a pigeon's egg, and which soon became filled with urine. In the middle line, just above the opening, a diastasis of the recti muscles could be felt. The pubic bones did not unite in a symphysis, but were separated by a space of three centimetres. This space was filled by a broad, elastic band, uniting the two bones. The testicles were retained in the inguinal canals. Diagnosis: Superior exstrophy of the bladder, following operation for exstrophy and epispadias. The history showed that the patient had been twice under surgical treatment. The first time from November 14, 1889, to June 30, 1890, at which time the urethra had been sutured and the operation of Trendelen-

burg performed upon the bladder. The result of the urethroplasty was satisfactory; the cystoplasty was unsuccessful. The patient had been readmitted to the clinic, where he remained from October 28, 1890, to June 22, 1891. At that time the operation of Rydygier was performed. The result of these two years' surgical treatment was the formation of a permeable urethra.

On May 12, 1898, Rutkowski proceeded to operate. A median incision, six centimetres long, was made, terminating below at the bladder. After opening the abdomen, a coil of ileum was brought out, and divided at two points, six centimetres apart. This six centimetres of intestine was isolated. The intestine was united by an end-to-end anastomosis with two rows of continuous silk suture, and replaced in the abdomen. The excised segment was divided longitudinally opposite its mesentery, thus forming a quadrilateral flap about forty square centimetres in size, attached to mesentery along its middle. After detaching the bladder from the abdominal wall, and enlarging the bladder opening, the intestinal flap was sutured by two rows of running suture into the defect. The deeper suture of catgut included the entire thickness of the bladder and intestinal walls, with exception of the mucosa. The outer suture of silk was applied as a Lembert suture. This gave a urinary bladder with an anterior wall formed from intestinal flap receiving its nourishment through its own segment of mesentery. Over the whole the abdominal wall was closed. A catheter was left in the urethra for permanent drainage of the bladder. The operation lasted an hour and a half. The condition of the patient immediately after the operation was excellent. The post-operative course of the case was ideal,—entirely afebrile. The wound healed *per primam*. On the tenth day the sutures were removed. The patient was then provided with a urine receptacle, and a compressing pad over the symphysis. This pad compressed the urethra at the symphysis diastasis, and the patient was able to retain his urine for three-fourths of an hour. The examination of the urine showed alkaline reaction, specific

gravity 1013, an almost imperceptible trace of albumen, and an increase of phosphates. The sediment contained numerous mucous shreds, phosphatic crystals, few flat epithelial cells, and broken-down pus-corpuscles. Eight weeks after the operation the patient was able to retain twenty-five cubic centimetres of urine in the bladder. Under pressure this amount could be increased to thirty cubic centimetres. He left the clinic two months after the operation.

In his further observations, Rutkowski studied the changes in the mesentery and the mucous membrane of the detached segment of intestine. This he did in the case of dogs experimentally operated upon. He observed that the vessels of the mesentery gradually became obliterated, and the epithelium of the intestine undergoes regressive changes, and gradually becomes replaced by the flat bladder epithelial cells.

J. P. WARBASSE (New York).

REVIEWS OF BOOKS.

A TEXT-BOOK OF HUMAN ANATOMY BY AMERICAN AUTHORS, edited by FREDERIC HENRY GERRISH, M.D., Professor of Anatomy in the Medical School of Maine, Bowdoin College. In one imperial octavo volume. Illustrated. Philadelphia and New York: Lea Brothers & Co., 1899.

This book is a contribution to anatomical literature by a number of gentlemen who are practical teachers in the department of science of which it treats. About one-half is written by Professor Gerrish, of the Medical School of Maine, who acts also as its editor. His collaborators are Professor Woolsey, of Cornell University Medical School, who treats of skeletology and the veins, Professor Murrich, of the University of Michigan, who presents the subject of embryology, Professor Bevan, of Rush Medical College, who describes the arterial system, Professor Keiller, of the Medical Department of the University of Texas, who deals with the peripheral nervous system and organs of special sense, and Professor Stewart, of the University-Bellevue Medical College, who discourses upon the organs of reproduction.

The preface defines the field intended to be occupied as that of a text-book for medical students; something between an encyclopædia and a pocket manual.

In just so far as recitations have superseded didactic lectures, it has become apparent to instructors in medical colleges that elaborate treatises on anatomy are ill-adapted to the needs of the student. Many attempts have been made to meet the demand for a text-book, but most have fallen short of the mark. Dr. Gerrish, therefore, had almost a clear field.

The model text-book of anatomy for medical students should

contain a clear, concise, and strictly scientific description of the important structures of the human body. In such descriptions as are attempted clearness should not be sacrificed to brevity, and scientific accuracy should not be departed from on any consideration. There are many details of minor practical importance worthy of but passing consideration, and some which may be omitted altogether with advantage.

The first thing which will impress one in examining "Gerish" is the illustrations. Of them there are many, and they are for the most part well selected. Their diagrammatic character and the free use of colors for the purpose of differentiation render them of special value. Selections are made very largely from Testut.

The articles by Dr. Bevan and Dr. Stewart are scarcely to be criticised. That of Dr. Keiller is excellent.

Dr. Murrich is unfortunate in having had assigned to him a subject out of place in a text-book of anatomy for medical students. In medical colleges embryology as well as histology is separately taught, as they should be. Seventy-five pages are thus given up in this book to the consideration of matter which might properly have been omitted.

The articles upon the anatomy of the bones and joints will occasion considerable disappointment. They have not been made as interesting as they might have been, and are not illustrated as felicitously as are the other parts of the book. The student will especially miss the indications upon the cuts of bones of the areas of muscular and ligamentous attachments. The language employed in the text is not always clear and sometimes incorrect. It is improper to speak of prominences upon bones "attaching" muscles, when it is meant that muscles are attached to them. To speak of the upper epiphysis of the fibula as "more vestigial" than the lower is unscientific. To call the lachrymal bone a "diminishing element" is calculated to confuse rather than enlighten the student. What idea would be conveyed to the reader

by the following expression: "The navicular is united in one continuous joint to the three cuneiform bones in front of it by (1) strong dorsal ligaments from the upper surface of the scaphoid to that of each of the three cuneiform bones; and (2) by plantar ligaments similarly disposed beneath and continuous with the fibres of the tibialis posterior tendon, which," *et cætera!*

Of the matter contributed by the editor, the article upon the central nervous system is by far the best. It presents the subject in sufficient detail, unless it be intended to make a special study of this department of human anatomy. The facts set forth in the articles on visceral anatomy, generally, are all that are required for the purposes of a text-book. In the selection of illustrations Dr. Gerrish displays extraordinary skill. Muscles are grouped with reference to their action on joints, the only strictly scientific method of presenting them. They are illustrated in a manner unique but impressive. The areas of both origin and insertion are indicated in solid color upon outlines of the bones and joined so as to display the form of the muscle. There is, however, a tendency to be noted which is undesirable in a book of this character,—to depart from a well-established nomenclature. This is to be condemned the more because the changes do not appear to rest upon any scientific basis. What can the rule be which governs naming the brachialis anticus, "brachialis," and the supinator longus, "brachio-radialis"?

The mechanical work upon the book is excellent, and its price not excessive. It is worthy of a place in the library of every anatomist.

WILLIAM W. BROWNING.

LEHRBUCH DER SPECIELLEN CHIRURGIE FÜR AERZTE UND STUDIRENDE. VON DR. FRANZ KONIG. VII. Auflage. II. Band. Berlin: August Hirschwald, 1899.

This volume presents more evidences of revision than does the first volume of this seventh edition. The reason for this is that it deals with the surgery of the abdomen, and the progress

in this branch of surgery has been so great that many changes have had to be introduced to cover a period of five years. Although the chapters on the diseases of the uterus and ovaries have been left out entirely, the number of pages is the same as in the previous edition. The chapters on peritonitis and operations upon the intestine have been rewritten and enlarged, but typhlitis and perityphlitis still stand for appendicitis. Although a lapse of five years shows changes on the subject of appendicitis in this work, and those changes in the direction of the American teaching, still it is only too evident that the German school has not yet the grasp upon this branch of surgery which gives it pre-eminence in most of the other departments of our art and science.

The chapters on abdominal tumors and intestinal obstruction are classical. The revision also brings the surgery of the bladder and kidney up to date. The words of commendation and praise which we applied to the former edition are also applicable to this. The author in his preface expresses the hope that after another five years the progress in surgery will have been so great as to necessitate another extensive revision of the book.

JAMES P. WARBASSE.

CORRESPONDENCE.

SPONTANEOUS RECOVERY FROM GANGRENOUS LITTRÉ'S HERNIA.

Editor ANNALS OF SURGERY :

I was greatly interested in Dr. Fowler's article on Littré's hernia, in the May number of *ANNALS OF SURGERY*. Under the head of prognosis he states that cases unrecognized and not operated on invariably die. Doubtless, such is the usual result, but a few years ago I saw a case recover.

The man was taken suddenly with great pain in abdomen, vomiting, etc. For about twenty-four hours his people applied hot applications, hot drinks, etc., and then called in a young physician of the neighborhood, who treated him for inflammation. About one week later I saw him. At this time a fæcal fistula had formed, and the skin and underlying cellular tissue, down to the muscles, were gangrenous. I cleansed it as thoroughly as possible and kept it so, and in the course of six months the fistula closed, the man recovered completely, and is alive to-day.

Evidently a small knuckle of gut had become caught in the inguinal ring and sloughed; adhesions had formed sufficient to prevent contamination of the abdominal cavity, and the following cicatricial contraction had closed the fistulous canal.

W. J. HERRINGTON.

BAD AXE, MICHIGAN.

GASTROPLICATION FOR DILATED STOMACH.

BY W. H. HORROCKS, F.R.C.S.,

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DILATATION of the stomach is so commonly considered a medical subject that it is reasonable to indicate under what conditions these cases come within the scope of surgical treatment. To understand this a brief sketch of the pathology of the condition is necessary. Dilatation of the stomach is a consequence of certain pathological conditions. Chronic dilatation may be due to obstruction at the pylorus, in the stomach itself, or rarely in the duodenum.

The pyloric obstruction is caused by thickening of the pyloric walls, by simple or malignant growths, or by pressure of tumors growing in the surrounding tissues. It may be due to cicatrices left by ulcers or the matting of tissues around the biliary passages, caused by the inflammation following the passage of gall-stones. The obstruction may be due to torsion or flexion, caused by displacement of the stomach. All these causes are more or less permanent in character. A spasmodic stricture of the pylorus may cause intermittent obstruction. This form of obstruction is most commonly due to an ulcer near the pylorus. Dilatation of the stomach may also occur independently of any obstruction at the pylorus.

The stomach walls may become thin and unable to propel the contents of the stomach, as a consequence of, or synchronously with, chronic catarrh of the stomach.

In obstructive pyloric disease compensatory hypertrophy is the first consequence; but this in time is followed by thinning of the walls and dilatation of the stomach. In the stomach the most fixed points are its cardiac and pyloric open-

ings, and its lesser curvature, and these parts are little changed in position when the stomach is dilated. The changes are chiefly in the lowering of the great curvature and an extension more to the left of the middle line. Hence, in the upright position, the great curvature occupies a lower position in relation to the pylorus in a dilated than in a normal stomach, and, consequently, the mechanical difficulty of emptying the stomach is increased. Added to this is the difficulty due to the muscular weakness of the thin walls of a dilated stomach, which forms a sac, in which fermentation is liable to occur, as the cavity is never completely emptied.

The patient, whose case is to be considered, was incapable of work from her great emaciation, due to constant vomiting. The abdomen showed signs of considerable dilatation of the stomach. The following notes briefly indicate the condition: M. McM., a servant, aged thirty-five years, was admitted to the infirmary on December 7, 1897, under Dr. Rabagliati, who transferred her to my care on January 31, 1898. At that time she was in an emaciated condition, weighing only four stones, nine pounds. She had enjoyed fairly good health until two years before her admission, when she began to have severe pain in the right side. This pain increased in severity, and, after a short time, was accompanied by vomiting, usually coming on about an hour after taking food. No blood was noticed in the vomit until a short time before admission. She had gradually lost weight, and became so weak that she was unable to do her work.

The patient was a thin, small woman, evidently much wasted. The examination of the heart showed that the apex was displaced outward. The apical sounds were booming, but free from murmur. The abdomen was somewhat full. The stomach extended below the umbilicus and into the left hypochondriac region. A distinct splash could be easily elicited at all times, as the fulness of the stomach mass disappeared. No thickening or tumor could be felt in the pyloric region.

The patient was put on a limited solid diet, with small quantities of fluid, and the stomach was daily washed out with weak sanitas lotion. Nutrient rectal injections were also given. Under this treatment she gained somewhat in weight, but the stomach

condition remained unaltered. As it was evident that she could not continue this treatment for an indefinite time, it was decided to find out the cause of the dilatation, and to deal with it, if possible. On March 11 a vertical incision, four and a half inches long, was made in the middle line above the umbilicus. The stomach was found to be dilated, its pylorus showing a slight circular constriction. A small transverse incision was made in the stomach wall near the pylorus. The interior of the stomach and the pyloric opening were explored with the finger. A depressed ulcer was found near the pylorus on the posterior wall of the stomach, which at this part was fixed by scar tissue. The pylorus admitted the finger readily and was not constricted. The opening in the stomach was then closed with continuous chromic gut sutures. To raise the lowered great curvature the anterior wall of the stomach was folded upon itself, and fixed in position by two rows of continuous catgut sutures.

From the examination it was evident that the pyloric ulcer was probably the origin of the trouble. This ulcer, during its early stages, possibly caused spasmodic stricture of the pylorus when the stomach emptied itself. Later the fixation of the pylorus caused a difficulty in emptying the stomach. It was evident that the increase in size of the stomach and the thinning of its walls were important factors in keeping up the dilatation. Mr. Barker, in such cases, speaks strongly in favor of posterior gastro-enterostomy, and condemns gastrorrhaphy as unscientific. This may be true where there is a permanent stricture of the pylorus, but where the stricture is only temporary, the lessening of the stomach cavity greatly alleviates the condition. The patient did well after the operation, and for a time the pain and sickness disappeared. A month after the operation the old trouble returned, the swelling of the dilated stomach could be easily felt to the left of the scar. On considering the case, it seemed probable that the stitches holding up the stomach had given way and that the left end of the stomach was still in a dilated condition. The pyloric part of the stomach was fixed to the abdominal wall. About this time a case, by Mr. Moynihan, was published in the *Lancet*, and the various methods of gastric suture discussed. By vertical sutures with silk he had obtained a good result. As the patient was still moribund, and had received benefit immediately after the

first operation, it was proposed that the abdomen should be again opened and the stomach stitched with silk thread.

On April 20 a vertical incision was made to the left of the scar of the first operation, and the abdomen opened. The stomach was found dilated towards its cardiac end, the pyloric part being adherent to the abdominal wall. The dilated part was drawn forward and six silk sutures put vertically in and out through the muscular and peritoneal walls of the stomach. The sutures were then tightened and a few additional Lembert stitches added, to give increased security. Patient did well after the operation; the wound healed without trouble. She was discharged and has since continued in a much better state of health. The weight when she left the hospital was six and a half stones. She is now able to take any food without pain, and has had no attacks of vomiting. The swelling of the stomach cannot be felt.

The failure of the first operation was due to the catgut sutures, which were not sufficiently lasting; and the method of holding in the stomach wall with the folds parallel to the lesser curvature is not so satisfactory as the later proceeding. The weak state of the patient during the first operation made the stitching process a somewhat hurried one. In the second operation Mr. Bennett's method was employed, and certainly gave better results.

It seems reasonable in cases of dilatation of the stomach, when lavage, diet, and medical treatment have had a fair trial, if the dilatation still continues, that an exploratory abdominal incision should be made, and some attempt made to remove the cause of the dilatation.

THE INTESTINAL TREATMENT OF TUBERCULOUS PERITONITIS.¹

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IN his "Principles and Practice of Medicine" Osler uses these words: "The treatment of tubercular peritonitis has fallen largely into the hands of the surgeons." And, after a long search among medical text-books, I ceased to wonder at this, for I could get but little information upon the medical treatment. Therefore the average practitioner, who depends upon his text-books, would seem to have no way of learning how to treat it. He is taught to treat peritonitis by opium, rest, etc., and to send the case to the surgeon.

The fact that improvement takes place after an abdominal incision, in cases of tubercular peritonitis, has led many surgeons to look upon the procedure as a cure. If, however, we believe with von Winckel that five years should elapse before the patient is considered cured, and remember that only about 15 per cent. have been under observation more than two years (Max Nassauer, *Münchener medicinische Wochenschrift*, April 19, 1898; "American Year-Book for 1899"), we must infer that such an opinion is premature. A case of my own may serve as a sample. I reported the young woman as teaching school eighteen months after the operation and, according to information given me, in good health. At the end of three years I received word that she was dead.

¹ Read in the Section of Obstetrics and Gynæcology of the American Medical Association at Columbus, June, 1899.

On account of the uncertainty of the reported cures I have not taken the time to tabulate them. I have, however, been struck with the similarity, in some recent reports, of the results of medical and surgical treatment.

F. Schroeder (*Inaugural Dissertation*, Bonn, 1897) reports upon twenty-four cases treated in the medical clinic at Bonn, with the following results: Deaths, 33 per cent.; unimproved, 20 per cent.; discharged about cured, 41 per cent.

Parker Sims (*Medical Record*, April 2, 1898), in reviewing the subject, says that some writers claim cures in 30 per cent., others in 24 per cent., by abdominal incision. His own conclusion is that improvement occurs in about 80 per cent., and a permanent cure in about 30 per cent.

Here we have 20 per cent. unimproved in the medical treatment against 80 per cent. improved in the surgical, and 41 per cent. discharged about cured by medical treatment against a permanent cure in about 30 per cent. by incision.

The treatment by abdominal incision, which is undoubtedly followed by immediate benefit, must still bear the burden of proving that the ultimate results are the better. Some cases have undoubtedly been demonstrated to be cured by a subsequent abdominal section; but, on the other hand, subsequent abdominal sections, in cases that had shown improvement, have demonstrated uninterrupted progress in the disease (M. Jaffe, Ueber den Werth der Laparotomie als Heilmittel gegen Bauchfelltuberkulose, *Centralblatt für Gynäkologie*, No. 40, 1898).

The most suspicious fact of all, in these cases that show improvement, is that no one can find out how or why the improvement takes place. It is not from the removal of fluid, because tapping does not produce the same improvement, and because cases without fluid accumulation are also benefited by it. It is not the exposure to air or light, because a quick operation works better than a long one. It is not anything that destroys the bacilli, because the introduction of germicides does not materially affect the results. To say with Tait that opening the abdomen produces a change in the physiologic char-

acter of the peritoneum, which enables it to destroy the tubercle bacillus, is contrary to our experience with the peritoneal cavity, for we know that to open the peritoneal cavity and expose it to air impairs the functions of the peritoneum from A to Z. It is said that the cure is produced by increased phagocytosis. But do not the new conditions that call for phagocytosis require all of the phagocytes and, perhaps, more for their own cure?

I have come to the conclusion that there is some benefit connected with the abdominal incision that is not connected with tapping or other forms of treatment, and that it is the same thing that causes improvement in almost all cases treated by abdominal section, even when pathological conditions in the peritoneal cavity are not removed or are not even found. Thus cases of neurasthenia, hysteria, epilepsy, pelvic pain, etc., are usually temporarily benefited by an abdominal section, although they may lose the benefit later.

This something, according to my observation, is the preparatory and after-treatment of that which belongs to abdominal section. There is no doubt but that the medical treatment, ordinarily used, for subacute and chronic tubercular peritonitis is in some respects similar in nature to that belonging to peritoneal section, but it deviates in laying more stress upon nourishment and tonics and less upon intestinal rest, intestinal depletion, and intestinal disinfection,—*i.e.*, it deviates in the most essential parts.

The quickest and best way of explaining the application of the treatment is, I think, to report a case in point.

Mrs. L. B. L., age thirty-three years, married thirteen years, five children, youngest two and a half years old, one abortion, twelve years ago, was treated for pulmonary tuberculosis fifteen years ago, at which time she had severe cough that lasted about two years. For a time the cough was much worse lying down, and she had to sleep in a chair. She has had a slight cough ever since.

In December, 1898, she complained of abdominal soreness and pains for two weeks, when the menstrual period, which had

been normal, came on with an increase of pains. The flow was slight for five days, and then profuse for five days.

She felt somewhat better until January 20, 1899, when she menstruated with some pain and was bloated. On the 1st of February she was taken down with acute peritonitis, accompanied by an increase of the abdominal distention.

The highest daily temperature ranged between 102° and 103° F.

She was brought to me for an operation February 26, at which time the temperature ranged between 99.8° and 102.6° F., always from one and a half to three degrees higher in the afternoon than in the morning. The pulse varied between 90 and 110, but was poor in quality. An encysted peritonitis was diagnosed, the accumulation of fluid reaching above the level of the umbilicus on the left side, and not quite as high up on the right. By vaginal indagation some induration could be felt beside the uterus. She was put upon strychnine, one-twentieth grain, and ten minims of the modified tincture of the citro-chloride of iron, three times daily, after meals, one drachm of sulphate of magnesia, twice daily, and half an ounce of brandy, four times daily.

Hot applications were applied to the abdomen. She was allowed a piece of broiled steak for dinner, thoroughly dried toast, three times daily, and liberal quantities of fluids. At the end of a week she was allowed an egg-nog every morning.

At the end of two weeks (March 9) the temperature and abdominal enlargement were the same, although the pulse remained between 90 and 100 and the nutrition and general appearance of the patient had improved. I now considered it the best time to operate, and gave her four grains of the mild mercuric chloride at bedtime, to be followed by salines the next morning, etc. By the next day I had made up my mind to give the plan of treatment I have been speaking of a trial, and proceeded to carry it out. The salines were stopped after sufficient had been given to produce four bowel movements, and then continued in drachm doses, twice or three times daily, as necessary to produce two semiliquid stools each day. All solid foods were withdrawn, and six ounces of peptonized milk, alternated with one ounce of liquid peptonoids, three hours apart, were ordered. Six grains of salol were prescribed four times daily. The iron and strychnine and brandy were continued. After three days a small quantity of thoroughly

dried toast was allowed, three times daily, and the diet was kept the same for ten days, or until March 20. After that she took Mellin's food a part of the time instead of the milk, and was allowed a little cottage cheese, butter, 40 per cent gluten biscuit, and from one to two ounces of a delicate cereal, such as corn-starch or rice, once daily.

From this time the improvement was steady. I marked the upper border of the fluid with ink each week, and demonstrated a steady diminution until, when she left the hospital, April 1, there was no dulness on the right side of the median line, and only a narrow border, extending from Poupart's ligament over the crest of the ilium, on the left side. The pains and tenderness and abdominal enlargement were gone, and she was gaining flesh. The temperature seldom reached 100° F., but usually marked from 99.2° to 99.6° in the afternoon.

I was unable to keep her under observation until cured, and am not attempting to prove that she is or will be cured. I am merely endeavoring to illustrate the effects of a certain method of treatment, as compared with abdominal section, upon the progress of the disease.

The progress of this case demonstrated to those of us who watched it that whenever the nourishment was pushed during the first two weeks the severity of the symptoms was increased. From the time that she was put upon the strictly liquid diet, salines, and salol the improvement was marked and sustained.

I am not discussing remote results, for that belongs to the future, but my experience with this and with similar cases that had been subjected to an operation has convinced me that in subacute as well as acute tuberculous peritonitis we must, for the moment, make the supporting treatment subservient to that of the inflammation, and that the *treatment of the alimentary canal*, in addition, of course, to the use of tonics and stimulants, is the one upon which we should depend. If we destroy the sources of local irritation, nature (if I may be allowed an ancient term) will often do the rest.

We should endeavor to keep the alimentary canal as asep-

tic as we do during and just after an abdominal section, and this, of course, applies also to the prodromic stage. Two or three liquid stools should be produced daily by salines. Eight or ten grains of salol, guaiacol, or an equivalent, should be given from three to four times daily to aid in disinfecting the alimentary canal, and possibly in producing some effect upon the bacilli. The diet should be entirely liquid, and should be such as to produce the minimum of gas or solid residuum in the intestinal canal.

If it is thought wise to try to affect the disease by mercurials, I think that calomel or blue mass would be better than inunction, because it would stimulate the action of the liver and aid in disinfecting the intestinal canal.

The same rest in bed is necessary as after an abdominal section. In subacute cases the patient usually tries to be up and about, and this increases the inflammation.

In subacute and chronic cases opium should never be given under any circumstances, except to check a diarrhœa that resists other medication. A proper restriction of the diet and hot fomentations, or an ice-bag, will relieve the pain, while bismuth and soda in connection with the salol and guaiacol will check a tendency to diarrhœa. Ordinarily I do not give bismuth, because I do not wish to check the action of the bowels.

If the same rapid improvement can thus be obtained without the abdominal incision, then the incision will be indicated only in the severe or neglected cases, in which the fluid cannot be made to disappear by absorption. Even then tapping can be substituted by those who have not the facilities for an aseptic section. At least there will be no excuse for opening the abdomen early and before time for absorption has been given, and before the intestinal treatment has been thoroughly tried.

If more innocuous specific germicides shall be discovered for tuberculosis, it is possible that they can be given by mouth or per anum, in sufficient quantities and for a sufficient length of time, to destroy the bacilli in the tissues. I have depended

mainly upon intestinal asepsis. Perhaps in the future intestinal antiseptics may add to its efficiency.

I would therefore recommend the following treatment:

During the first few days of an acute attack the usual treatment for acute peritonitis would be indicated. After the first few days no opium, but the continuation of hot fomentations, if necessary, for pain and discomfort.

Enough calomel may be administered to turn the stools to a dark green. As soon as the stomach will tolerate them salines are to be given in divided doses, to produce two or three soft or liquid stools daily.

The diet must be fluid and in regulated quantities, so as to produce no intestinal gases, until the subacute symptoms have passed, and then only such solid may be allowed as will neither leave a solid residuum nor produce gas either in the stomach or bowels. It is the want of strict and intelligent attention to what is taken as nourishment that leads to intestinal pain, distention, nausea, increase of the peritonitis and effusion, and the necessity for an opiate.

Salol, guaiacol, or creosote are indicated both for their antiseptic action and for a possible effect upon Koch's bacillus.

The patients must be kept quietly in bed until all abdominal tenderness is gone, and the afternoon temperature is almost normal, and they must be careful to be more quiet whenever there is any rise in temperature or indications of abdominal tenderness or pain.

Tonics, stimulants, and general remedies that may be found curative of tuberculous infection are not to be neglected.

The patient must be kept under systematic treatment for several months, and should be cautioned to restrict her diet to food that will be easily digested and non-irritating to the bowels, for we know that nine out of ten people who are not careful in eating are almost constantly subject to more or less intestinal irritation.

INTERSCAPULO-THORACIC AMPUTATION.¹

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IN this note upon the interscapulo-thoracic amputation of the French, I desire to discuss the various procedures that have been resorted to in this amputation, and to give in detail a new method, at the same time limiting my remarks to pathological cases,—*i.e.*, morbid growths. Of traumatic cases requiring this operation I have had no experience.

Berger ("L'Amputation du Membre supérieur," etc., Paris, 1887) has clearly pointed out that the key of the situation is in the control of hæmorrhage; therefore the best method will be one which speedily and clearly exposes the subclavian artery and vein, and at the same time gives a wide field for the necessary ligation. In examining the records of between forty and fifty of the reported cases, I find nine different ways of dealing with the hæmorrhage.

(1) Simple compression of the subclavian vessels. This must always be dangerous and uncertain, as you can never be sure of completely controlling the hæmorrhage; also, there is considerable danger of air being drawn into the vein before that vessel is secured with a ligature. Air has entered the vein on several occasions, although it has not always proved fatal.

(2) Resection of a portion of the clavicle with compression of the vessels. This is also objectionable for the reasons already stated.

(3) Formal ligation of the subclavian artery as the preliminary step of the amputation. This ligation is often diffi-

¹ Read before the Philadelphia Academy of Surgery, May 1, 1899.



FIG. 2.—Sarcoma of shoulder (posterior view).



FIG. 1.—Sarcoma of shoulder submitted to interscapulo-thoracic amputation (anterior view).

cult and tedious, owing to the smallness and depth of the field in which the vessels are exposed, and there is considerable danger of wounding them before they can be secured.

(4) Formal ligation of the vessels at some time prior to beginning the amputation. This was done once by Wyeth (personal communication) under cocaine, before the ether was administered for the amputation. The same objections will hold here as in number 3, with the added one that, if much time elapses between the ligation and the amputation, gangrene of the arm may follow.

(5) Resection of the middle portion of the clavicle with ligation of the artery, the vein remaining unsecured until just previous to the time of cutting it. This leaves a very vulnerable vessel needlessly exposed.

(6) Ligation of the artery, and proceeding with the amputation, leaving the vein and brachial nerves as the last tissues to be divided. This seems also needlessly dangerous, as the vein could so readily be injured or torn.

(7) Beginning with a T-shaped incision over the scapula and working forward, leaving the great vessels alone until nearly the close of the operation. This must always lead to a maximum of hæmorrhage, as the source of the blood-supply is not dealt with until the end of the operation.

(8) Resection of the middle portion of the clavicle with ligation of both the artery and vein. This is recommended by nearly all authorities, and is at present considered the operation of choice. And yet it is not free from difficulties and dangers. Macnamara (*Lancet*, 1878, Vol. i, p. 669) resected the clavicle, but could not find the artery, owing to the large venous trunks exposed. Nevertheless, the operation was persisted in, the hæmorrhage was enormous, and the patient died the following day. Lund (*British Medical Journal*, 1880, Vol. ii, p. 617), while resecting the clavicle, wounded the subscapular artery, and experienced great difficulty with the hæmorrhage. Von Langenbeck (*Archiv für klinische Chirurgie*, 1862, Vol. iii, p. 340) experienced considerable difficulty in ligating the vessels after resecting the clavicle. Ollier (*Lyon Médical*, February, 1885, Vol. xviii, p. 158) resected the

clavicle and had to ligate the vein first, and then experienced considerable trouble in getting the artery. Morisani (*Il Morgagni*, 1885, tome xxvii, p. 505) had great difficulty in finding the vessels after resecting the clavicle. Keen (*American Journal of the Medical Sciences*, June, 1894) also found the ligation of the vessels extremely difficult, and ruptured a large vein under the inner sawn end of the clavicle, which produced a very annoying hæmorrhage. He states that most of the time spent on the operation was consumed in securing the vessels. It is therefore evident that this procedure is not always simple and devoid of risk, owing to the narrowness of the field and the depth at which the vessels are exposed, and it leaves the sawn end of the clavicle as a constant menace to the adjacent veins while the operation is being completed. Again, you are advised to resect the clavicle within the periosteum whenever possible, leaving to the patient the inner third of the bone and two-thirds of the periosteum. Such a procedure, when any portion of the clavicle is involved in a malignant growth, must of necessity defeat all hope of a radical cure, and, to my mind, nothing short of the removal of the whole bone with its periosteum should be attempted.

(9) Disarticulation of the sternal end of the clavicle with compression of the vessels. This has been done by one man only, Mussy (*American Journal of the Medical Sciences*, 1837, Vol. xxi, p. 390), in 1837, and has since been condemned by all authorities who refer to the case. The compression of the vessels was of course faulty, and resulted in air entering the vein prior to its ligation, but after the amputation had been completed. Berger says that (*Ibid.* p. 294) "the disarticulation of the internal end of the clavicle must be formally rejected; it exposes the subclavian vein to being wounded: the single surgeon who has practised it, Mussy, saw air enter the vein in question." Air entered the vein after the amputation proper was completed, and only as a fault of the compression prior to the securing of the vessel. That the disarticulation of the clavicle had anything to do with it I cannot see; nor can I understand why a resection of the clavicle over the site of the vessels is less dangerous than a disarticulation three inches or

more away from them. [This reference was found after my patient had been operated upon.]

(10) Disarticulation of the sternal end of the clavicle, with ligation of the artery and vein. This method was used in the case about to be reported; and I give the full details of the procedure, dividing it, for convenience, into seven steps.

(1) The incision is begun over the sternal end of the clavicle, carried along that bone to about its middle, and then curved downward to the anterior axillary fold. The skin and superficial fascia are dissected up, exposing well the inner two-thirds of the clavicle.

(2) The clavicle is disarticulated by severing its attachments to the sternum and the rhomboid ligament, the clavicular attachment of the sterno-cleido-mastoid muscle is cut close to the bone, and the clavicular portion of the pectoralis major is separated with the finger from the costal portion of the muscle up to the anterior axillary fold.

(3) The clavicle is now pulled upward and outward, and if the subclavius muscle does not readily strip off, its attachment to the first rib is divided. The pectoralis minor will now be well exposed, and it is divided, and the coracoid portion reflected upward with the clavicle. This exposes the axilla fully, and the vessels are seen traversing it from the anterior scalenus muscle down.

(4) The sheath of the vessels is opened and the vein dissected away from the underlying artery. Two ligatures are passed around the artery and tied. The arm is then held up to empty it of blood, while two ligatures are passed around the vein, but these are not tied until the arm is blanched. This renders the use of an Esmarch bandage unnecessary. It must be noted that the cephalic vein has joined the axillary below these ligatures, or else separate ligature of that vessel is required.

(5) The vessels are now severed, together with the brachial plexus of nerves, and the costal portion of the pectoralis major. This completes the division of the anterior attachments of the arm.

(6) A posterior incision is now carried from some point

on the anterior incision (as near the tumor as it is deemed advisable to go) directly backward and downward to the inferior angle of the scapula, and up again to the posterior axillary fold. The skin and superficial fascia are dissected up for a short distance (half an inch to an inch).

(7) The trapezius is now severed and the transversalis colli or posterior scapular artery secured; the omo-hyoid muscle is cut and the suprascapular artery secured, and the muscles attached to the inner border of the scapula are rapidly divided close to the bone; then the serratus magnus and latissimus dorsi are cut, the latter at the posterior axillary fold. The arm is now held to the body by the skin of the axilla alone. If there is sufficient flap to cover the wound, the anterior and posterior incisions are joined through the axilla, but if more skin is needed, a flap may be raised from the under surface of the arm. The wound is then closed with suitable provision for drainage.

The procedure just detailed seems to have the following advantage:

(a) It gives the widest and fullest possible exposure of the vessels, and decreases the accidents of ligation to a minimum.

(b) The disarticulation of the clavicle is simpler, quicker, and easier than a resection of the bone, and the danger of wounding important vessels is less, because these structures are well protected by the sterno-hyoid and sterno-thyroid muscles.

(c) The elevation of the arm, after securing the artery and before the vein is tied, makes a practically bloodless amputation.

(d) The suprascapular and posterior scapular arteries (the only other vessels that can bleed) are easily picked up before being cut.

(e) In malignant growths, where the outer end of the clavicle is involved, there is less risk of a return if the entire bone with its periosteum is removed.

(f) It removes everything in one piece, a more surgical procedure when dealing with malignant growths.

A. E. T., white, aged forty-nine years, born in England.

Family History.—Father living and well, aged seventy-nine; mother healthy and strong; died at seventy-six from influenza. Three brothers and one sister alive and well.

Personal History.—Always strong and healthy. Rheumatism, twelve years ago, in knee. Gonorrhœa five years ago. No history of syphilis. For past thirty years has drunk freely of whiskey. Occupations: Served nine years in the British navy, followed by eight years in the merchant marine; since then he has been almost constantly a driver of wagons and trucks, which frequently necessitated his carrying heavy weights on his shoulder. Three and a half years ago, while placing a heavy box on his left shoulder, he felt a sharp pain as though a nail had pierced the skin. An immediate examination revealed a small bluish lump, the size of a five-cent piece, on the upper edge of the scapula, hard and tender to the touch. Since then he has not carried parcels on that shoulder. In six months the tumor had grown to the size and shape of a hen's egg, and was frequently painful, even when not pressed upon. This pain sent him to the Polyclinic Hospital, where the growth was excised. Almost immediately it returned again, and at the end of a year was the size of an orange, and at intervals painful. He was admitted to the Pennsylvania Hospital in May, 1897, and Dr. Ashhurst excised the growth, including the outer one-fifth of the clavicle and the acromion process of the scapula. Shortly afterwards the growth again returned, with periodical attacks of severe pain. Three months ago the skin ulcerated over a nodule on the anterior portion of the shoulder. This rapidly became fungoid in character, and oozed blood constantly, and occasionally was subject to more pronounced hæmorrhage. Since the ulceration of the skin appeared the patient has had but little pain. He was again admitted to the Pennsylvania Hospital on April 3, 1899, after a severe hæmorrhage from the fungoid mass.

General condition good, but anæmic. Soft, anæmic murmur heard best over pulmonary area; radials slightly sclerosed, left more so than right. Urine, first examination, negative, but a second specimen showed a trace of albumen with a few narrow, pale, hyaline casts. Other organs negative to examination. The tumor extends from the top of the anterior axillary fold to the outer third of the clavicle, to the middle of the outer margin of the tra-

pezius, to the middle of the scapula, involving parts of the deltoid, trapezius, and supra- and infraspinatus muscles. It is nodular, firm, and intimately connected to bone, and for the most part hard, except in two places, where the skin has ulcerated. One of these ulcers has developed a fungous mass one and a half inches in diameter. The skin over the remainder of the growth is brawny and tense.

The patient was placed on a tonic treatment for a few days, to build him up, and on April 12 he was etherized, and the operation performed as detailed above. At no time was any difficulty encountered. The exposure of the vessels was extensive and free, and their dissection very easy. The cephalic vein was found emptying into the main trunk at the first rib, and in a small exposure of the parts it would have been impossible to ligate the artery until after the veins had been dealt with. Three silk ligatures were required for the vein, one to the subclavian, one to the axillary, and one to the cephalic, and the portions between divided. By ligating the artery and then elevating the limb before the vein was tied, a minimum of blood remained in the arm, and practically none was lost to the patient. The only ligatures required were those on the artery and vein, the suprascapular and transversalis colli being twisted. The time of operation was one hour and six minutes, which includes the dressing and removal of the patient from the room. The operation was slowly and cautiously done, as it was my first effort, and I feel sure that, in a similar case, I could now shorten this time from ten to twelve minutes, bringing it well within an hour. This would be a distinct gain of one hour, as the average time for this operation is in the neighborhood of two hours, and on some occasions it has lasted as long as three and four hours. The patient was out of bed on the ninth day, and his recovery has been uneventful, except that a small portion of the outer posterior flap necrosed (probably from lack of blood-supply, as there was no infection or rise of temperature). This is now healing by granulation. The shape of the remaining scar is almost like three radiating lines drawn 120 degrees apart.

I desire to thank Dr. Charles D. Hart for the careful notes of the case, and Dr. Francis J. Stewart for the excellent photographs here reproduced.

REPORT OF A CASE OF RESECTION OF THE
LIVER FOR THE REMOVAL OF A NEOPLASM,
WITH A TABLE OF SEVENTY-SIX CASES
OF RESECTION OF THE LIVER FOR
HEPATIC TUMORS.¹

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Two years ago I had the honor of reading before this society an account of the removal of an angioma of the liver in March, 1897, by extraperitoneal elastic constriction (*Pennsylvania Medical Journal*, Pittsburg, October, 1897). This was my second operation for a tumor of the liver, the first having been for an adenoma of the bile-ducts, removed in October, 1891 (*Boston Medical and Surgical Journal*, April 28, 1892), by the Paquelin cautery and enucleation by the finger-nail. Both of these cases recovered. The case operated on in 1891 I saw about a year ago, when she was in excellent health. The case of 1897 wrote me, under date of May 10, 1899, that, apart from rheumatism and some general debility, she is in excellent health. No recurrence has occurred in either case, and, in fact, none is to be expected.

I have now the pleasure of reporting a third case of resection of the liver for a tumor far larger than either of the other two, and with a similarly successful issue. The patient has made an excellent recovery.

The history of this third case is as follows:

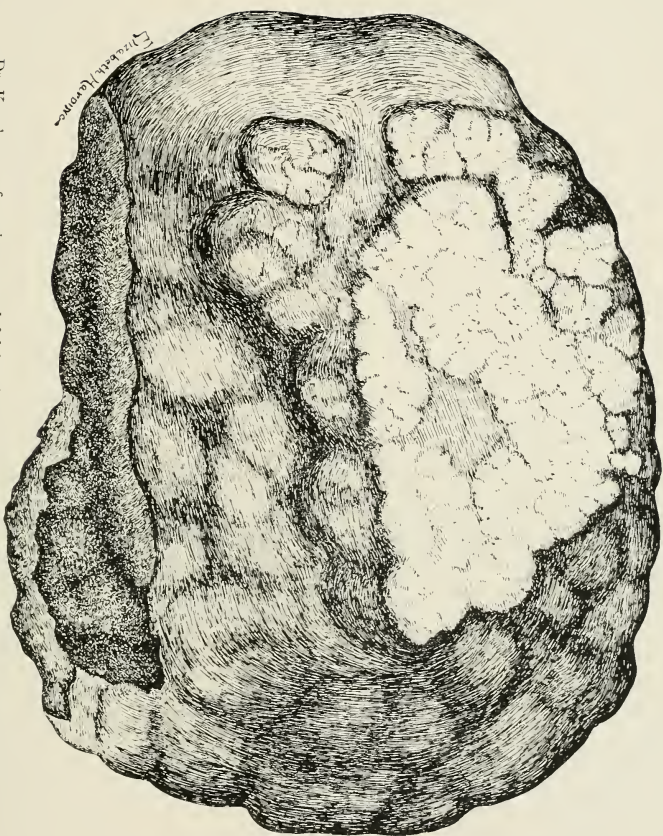
¹ Read before the Pennsylvania State Medical Society at Johnstown, May 17, 1899.

A. F., an Englishman, aged fifty years, white, married, cloth-inspector, entered the Jefferson Medical College Hospital April 18, 1899. His father is living at the age of seventy-four; his mother died at forty-two of unknown trouble. Two of his brothers and sisters died during infancy; four brothers are living and in excellent health. There is no family history of tuberculosis or of malignant disease.

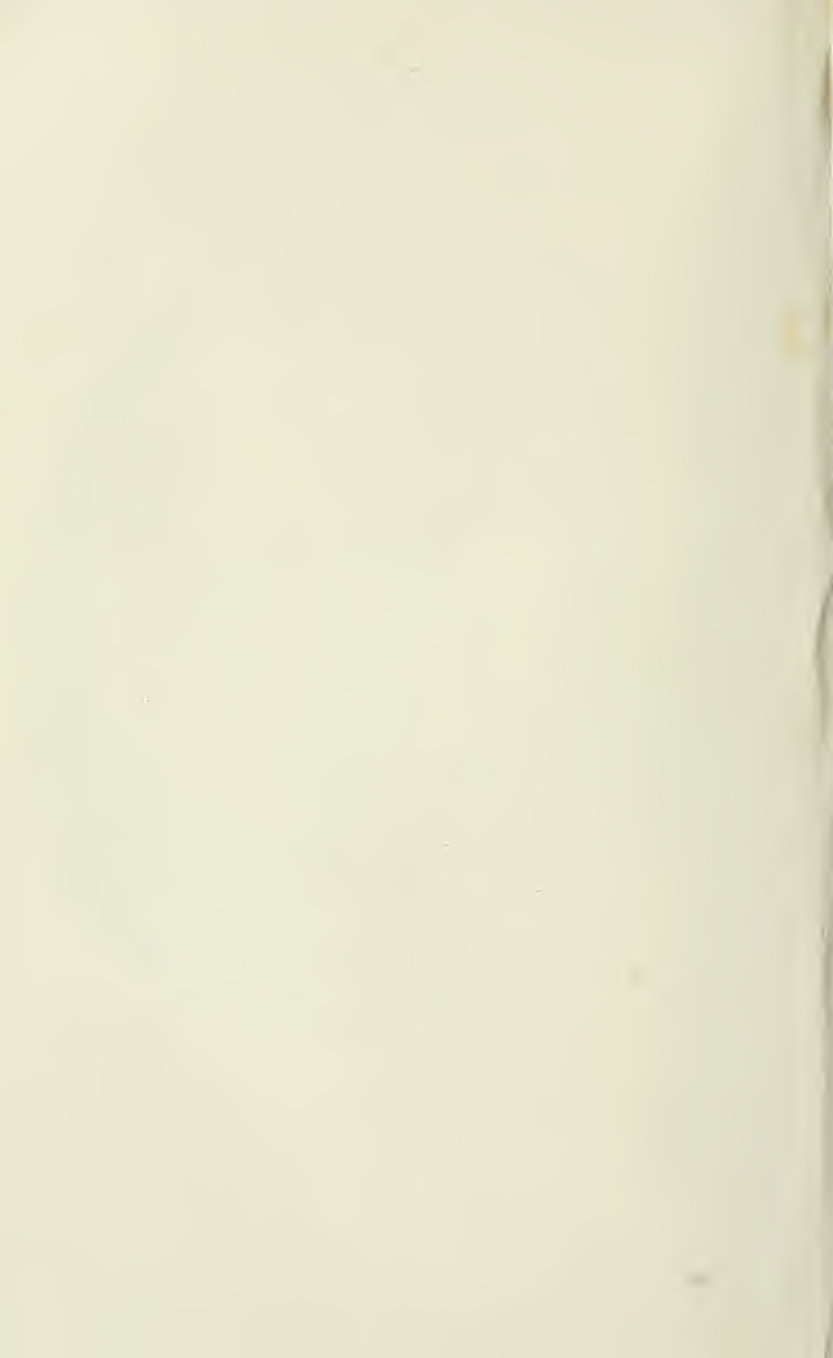
In childhood he suffered from measles and whooping-cough. At eighteen he was confined to his bed for six months with hydrothorax, but made an excellent recovery. He had a light attack of the grippe eight years ago. He admits gonorrhœa, but absolutely denies any syphilitic infection. He uses tobacco moderately, and has been accustomed to drinking three or four glasses of beer a day for the past thirty years. He rarely uses whiskey, and never to excess. He has always had excellent health till three months ago. At that time he weighed 235 pounds. He has a moderately marked lateral nystagmus, which has been hereditary in five generations. His vision is unimpaired.

About the middle of January, 1899, he observed a dull pain in his abdomen just below the umbilicus, but later the pain was felt in the epigastrium. It was only moderately severe, and was transient until six weeks ago, since which time it has been almost constant. It is of a dull, grinding character, and increases after meals. His appetite has been poor for the last two months. At no time has he been nauseated, nor has he ever vomited since his sickness began. The bowels are moved daily, the stools are normal. He has lost thirty pounds in weight, his present weight being 205 pounds. He feels very weak, and has not worked for ten weeks past.

Immediately upon uncovering the abdomen the epigastrium is seen to bulge forward in a uniformly rounded swelling. The elevation above what would be the normal contour of the abdomen is about two to three cubic centimetres. On palpation there is immediately perceived a hard, firm, movable mass, as large as a large hand, entirely filling the epigastric region and extending to the level of the umbilicus. It is dull on percussion, and this dulness is continuous with that of the liver. The examination of the heart and lungs and the abdominal viscera reveals nothing abnormal. The urine is clear, amber, reaction acid, contains neither albumen nor sugar; the urea is 1.9 per cent.



Dr. Keen's case of carcinomatous left lobe of the liver removed by operation. About natural size.



April 19, 1899: At my request Dr. S. Solis-Cohen inserted the gastrodiaphanoscope, which showed an absolutely opaque epigastrium. A test-meal was given, and hydrochloric acid was found in normal proportion. The result of the test-meal, the gastrodiaphanoscope, the physical examination, and absence of vomiting convinced me that the tumor was probably not connected with the stomach. As he had never had any jaundice or other hepatic disturbance and no disturbance with the bowels, I was quite uncertain as to the nature of the trouble. The physical examination, apart from percussion, did not reveal the continuity of the tumor with any of the abdominal viscera until he was etherized, at the time of the operation, when Drs. Spencer and Roe, two of my assistants, felt quite certain that they could determine a physical continuity of the tumor with the liver. I advised an exploratory operation, which he accepted at once.

Operation April 23, 1899. As soon as the abdomen was opened in the middle line it became clear that the tumor was hepatic. On drawing it outside of the abdomen I found a number of large nodules occupying the entire left lobe of the liver. My first impression was that it was a carcinoma, but later, on cutting out a piece for microscopic examination, I rather thought it possibly a gumma or, though less likely, caseous tubercular masses. Passing my hand carefully over the rest of the liver, I found that there were no other nodules that could be discovered, nor was there any involvement of the lymphatic glands. Dr. J. Chalmers Da Costa and Dr. Geo. W. Spencer, who assisted me, reached the same conclusion as to the limitation of the tumor to the left lobe. It seemed to be possible to remove the entire left lobe of the liver and with it the whole of the tumor, and I proceeded at once to its extirpation. The operation was done entirely with the Paquelin cautery. It took from twenty to thirty minutes to sever the left lobe from the remainder of the liver. The hæmorrhage was not very severe, excepting when I burnt into some of the larger veins. Each of these, when opened, I was able instantly to close by my left forefinger. Then, temporarily laying aside the cautery, I passed a catgut ligature under each by means of a Hagedorn needle, and one of my assistants tied it slowly but firmly. Five ligatures were thus applied. Three of the veins required ligature of both of the divided ends. The hæmorrhage, except from these large veins, was arrested by the

Paquelin cautery, except that occasionally, when I laid aside the cautery to apply a ligature, temporary packing with iodoform gauze was of great service in arresting the parenchymatous hæmorrhage. The amount of blood lost I judged to be about eight to ten ounces; but as I feared that there might be a severe loss of blood before I got through, as soon as I began the hepatic portion of the operation Dr. W. J. Roe began an intravenous saline injection, throwing a quart of the solution into the circulation. Of course, the surrounding tissues were well protected against the cautery by wet aseptic gauze pads.

When the tumor was removed, I found that I was able to obliterate a part of the resulting raw surface by folding the edge of the liver upon itself like the flaps of an amputation, as I had made the cautery incision obliquely. A few catgut stitches approximated these flaps, but still there was left over one-half of the burnt surface exposed in the peritoneal cavity. I feared there might be some hæmorrhage or later adhesions, and to prevent both, as well as to provide for the escape of the bile into the peritoneal cavity, I packed some iodoform gauze against the liver, leaving the end protruding through the abdominal wound. The abdominal cavity was then carefully flushed out with salt solution (though but few clots were thus removed), and the abdominal wound was then closed, excepting at the point where the gauze packing protruded.

The tumor measured fourteen centimetres (five and one-half inches) in length; eleven centimetres (four and one-quarter inches) in breadth, and its thickness was seven and one-half centimetres (three inches).¹ Its circumference was twenty-eight by thirty-three and one-half centimetres (eleven by thirteen and one-eighth inches) in the two directions. The raw surface left, where it had been detached from the liver, was thirteen centimetres (five and one-half inches) by six centimetres (two and three-eighths inches). Its weight was one pound and five ounces. Fig. 1 is a drawing of the natural size. A photograph was found to give a less satisfactory idea of its appearance.

The post-operative history is very simple. With the exception of vomiting, which continued for nearly forty-eight hours, and of hiccough on the second day, there was nothing specially

¹These measurements were made immediately after the operation. Professor Coplin's were made a day later and are slightly less.

noticeable. Ice, champagne, quarter-grain doses of cocaine, and similar doses of carbolic acid, had no effect on the vomiting. At the end of forty-eight hours, after washing out his stomach, both the vomiting and hiccough entirely ceased.

His temperature immediately after the operation fell to 96.8° F., and afterwards fluctuated a little above and below the normal. At the end of forty-eight hours I withdrew the gauze packing. This was stained in streaks with bile. By the fourth day the discharge of bile through the opening left by removal of the gauze was quite free, my estimate being that three to four ounces of bile escaped in the twenty-four hours. This gradually diminished, and ceased by the twelfth day, a little serous discharge then taking its place. This became slightly purulent after two weeks. The wound is now entirely well, except a small shallow sinus which will soon close. The patient is out of bed.

Remarks.—The diagnosis was not clear until after he was etherized, when the physical continuity of the tumor with the liver was fairly well established. Tumor of the stomach was rightly excluded. The nature of the tumor was at first doubtful. But the final conclusion of Professor Coplin, as will be seen by his report, is that it is a carcinoma. Professors Wm. H. Welch and T. M. Prudden, to whom sections were sent, coincided in this view.

Technique of Removal.—From the surgical stand-point this is most interesting. My first case was done partly by the Paquelin cautery and partly by enucleation with the finger-nail, the stump being treated intraperitoneally without drainage; my second was done by extraperitoneal elastic ligature.

When I decided to attack this tumor, the absence of any pedicle and its very broad base (thirteen by six centimetres, or five and one-half by two and three-eighths inches) precluded elastic ligature, a procedure which, in my opinion, is only exceptionally advisable. My experience in my first case emboldened me to use the thermocautery and ligature of the larger vessels, and the excellent result justified my decision. In fact, after my experience with these three cases, I should hardly hesitate to attack almost any hepatic tumor without regard to its size. The adhesions which might be present and

the amount of glandular infection would be much more determining factors as to the operability of any liver neoplasm.

Five vessels, including some hepatic tissue, were tied with catgut. If the ligature is tightened slowly, but firmly, the large hepatic blood-vessels can be treated in the same manner as other blood-vessels. As Kousnetzoff and Pensky (*Revue de Chirurgie*, 1896, pp. 501, 954) and Auvray (*ibid.*, 1897, p. 319) have shown, these vessels are strong, the veins being even stronger than the arteries. All the hæmorrhage from the entire broad surface of attachment was easily controlled by the cautery, aided occasionally by temporary packing with iodoform gauze.¹

The burning through the liver-substance should be done slowly and with the cautery only heated to a dull red so as to char the tissues. Only in this way is a sufficient eschar formed to arrest the bleeding. I took from twenty to thirty minutes (including the time required for placing the five ligatures) for the amputation in this case. The cautery was repeatedly and slowly drawn across the liver tissue, burning but little of it at each stroke. At points where the hæmorrhage was not quickly arrested, repeated applications of the cautery were required to sear the surface sufficiently. At no time was I anxious as to any particular hæmorrhage, though I confess I was in constant dread lest alarming and possibly uncontrollable hæmorrhage might occur; and I was conscious of a sigh of relief when the last portion of tissue had been cut through and the tumor lay free in my grasp without any notable loss of blood.

A few catgut sutures reduced the large charred surface to some extent, but it was so large that I deemed possible

¹ Much of the iodoform gauze made by commercial firms is a poor hæmostatic. At the Jefferson Hospital and my private hospital I have used with far greater satisfaction gauze made by the following formula, devised by our ingenious clinical orderly at the Jefferson, John Johnson: "Four ounces each, by weight, of iodoform, glycerine, and alcohol, and six grains of corrosive sublimate are well mixed and allowed to stand for three days. Moist bichloride gauze is then saturated with the emulsion, allowed to drip till almost dry, and is then kept in sterilized covered glass jars."

hæmorrhage or later adhesions and certain free discharge of bile good reasons for temporary iodoform gauze packing and drainage. The packing was removed in forty-eight hours. No hæmorrhage occurred, but bile escaped to a considerable extent from the fourth to the twelfth day. In spite of this, if, in any future case, I should have to deal with a *small*, charred surface after removing a hepatic tumor, I shall feel sorely tempted to test the absorbent powers of the peritoneum by immediate closure of the abdominal incision without drainage. If experience shows that no ill results follow, I would then test the method in cases in which the escape of bile would probably be large. Possibly the peritoneum will absorb it all, and if not, a later small incision, or possibly even aspiration alone, might be sufficient to remove any accumulation. At all events, the procedure is worthy of consideration.

Prognosis.—Whether there will be a recurrence in this case, time alone can tell. The absolute limitation of the tumor to the left lobe and the absence of any recognizable lymphatic involvement inspire me with considerable hope. This hope is made stronger by the experience of others. Thus, Hochenegg's case (No. 13 of my prior table) was alive three years after removal of a supposed carcinoma; von Bergmann's (No. 35), after a year; Lücke's (No. 18), a case of carcinoma as large as a fist, was well after three years; and Schrader's case (No. 53) was well as long as seven years after operation. If we may cure 50 per cent. of cases of cancer of the breast and over 50 per cent. of cases of cancer of the rectum and the uterus, why should we not get equally good results at least in those cases of cancer of the liver which are well limited and with little or no lymphatic involvement? Every case, saving those manifestly beyond relief, therefore, should be *explored*, and the later steps be determined by what is found. Exploratory *coeliotomy* is so safe that the patient should not be denied the possibility of cure. As I have urged in my Cartwright lectures on the "Surgery of the Stomach," *early exploratory caliotomy* will save not a few lives now lost. All the more is this true now that our resources in dealing with tumors of the

liver enable us to remove those which, a few years ago, would have been deemed inoperable, and our results, both as to immediate and permanent recovery, are so encouraging.

To my first paper (1892) was appended a table of twenty cases of resection of the liver for hepatic tumors, compiled by Dr. Thompson S. Westcott. In 1897, in my second paper, Dr. Geo. W. Spencer's table enlarged the list to fifty-nine. Drs. H. H. Cushing and M. L. Downs have kindly collected for me all the additional cases they could find reported in the literature of the last two years. Without the aid of the library of the College of Physicians of Philadelphia and the generous help so freely extended by the library of the Surgeon-General U.S.A., these tabulations of results in a new field of operative surgery would have been impossible.

I have been not a little embarrassed in deciding what cases should be included and what excluded. Thus, Posadas (*Revue de Chirurgie*, March, 1899, 374) reports twenty-three cases of hepatic hydatid tumors, which were treated by enucleation, suture of the hepatic incision, and immediate closure of the abdominal wound, of which nineteen cases recovered and four died; and three other successful cases, similarly treated, excepting that because of prior suppuration, drainage was required. As none of these required resection or amputation of any of the liver-substance, I have excluded them from my table, though with some hesitation. Three cases treated by marsupialization and drainage I excluded with less doubt.

The case of Jawadynski (*Revue de Chirurgie*, 1898, No. 9, p. 83) I have excluded, as the operation was limited to opening the gall-bladder, the attempt to remove the tumor being abandoned. The case of Knorp (*Pacific Recorder of Medicine and Surgery*, 1899, 207) was excluded, since the operation consisted only of incision of the liver and the removal of eight gall-stones embedded in the liver-substance. So, too, as in White's second case (*British Medical Journal*, 1897, ii, 398), the incision of the cyst and suture of the wound to the abdominal wall, was done; in Bobroff's case (*Archiv für*

klinische Chirurgie, 1898, lvi, 822) only a part of the cyst wall was excised; in Patry's case (*Revue Médicale de la Suisse romande*, 1896, in the *Centralblatt für Chirurgie*, 1897, 1114), a case of hernia of a congenital capsular cyst, the membrane was resected and closed by continuous suture; in O'Connor's cases (*Medical Press and Circular*, 1897, p. 183) only tapping incision and packing were done, I have excluded all, as not involving a true "resection of the liver." Omitting these cases, there remain seventeen cases to be added to the fifty-nine formerly tabulated, making seventy-six in all.

Following the analysis in my former papers, the results of the seventy-six cases are as follows:

(1) *Mortality*.—The termination of Cases 12 and 68 is uncertain. Of the other seventy-four, sixty-three recovered and eleven died,—a mortality of 14.9 per cent. The cause of death in the fatal cases has been shock, hæmorrhage, and exhaustion, eight; septicæmia, two; and pulmonary embolism, one.

(2) *Age*.—The extremes were two and a half days and sixty-seven years. By decades the cases occurred as follows:

Under twenty years of age	5
Twenty-one to thirty	15
Thirty-one to forty	14
Forty-one to fifty	14
Fifty-one to sixty	11
Sixty-one to seventy	3
	—
Total	62

(3) *Sex*.—There were thirteen males and fifty-five females, a great disproportion due, I think, chiefly to the looser clothing worn by men.

(4) *Diagnosis* and (5) *Duration*.—I have nothing of importance to add to what was said in my second paper.

(6) *Varieties*.—

Removal of constricted, accessory, or herniated left lobe	5
Syphiloma	12
Carcinoma	17
Adenoma	7
Sarcoma	5
Angioma	4
Cavernoma	1
Cystoma	1
Angiofibroma	1
Small calculi	1
Endothelioma	1
Echinococcus and hydatid cysts	20
	—
Total	75

(7) *Technique*.—Sufficient has already been said upon this point in the paper itself.

(8) Pathological report of Professor Coplin and Dr. M. B. Tinker:

Specimen.—Tumor of left lobe of liver.

The specimen consists of a tumor of the left lobe of the liver, weighing 525 grammes. It measures thirteen and three-quarters centimetres in length (really the width of the lobe), nine and one-half centimetres in width, and the thickness varies from five to six and one-half centimetres. One part of the margin of the mass presents the rounded contour of the liver lobe, but the edge is much thickened and rounded instead of the normal sharp-edge, except for a distance of two or three centimetres; the rest of the margin is cut square across, and is charred and blackened from the use of the cautery. The surface has the smooth, shining appearance of the normal peritoneum; its color is the reddish color of the liver, mottled by irregular, whitish splotches from two to six centimetres in diameter; these spots mark the location of rounded nodules, which do not rise over one-tenth to one centimetre above the surface. Transverse and longitudinal cuts were made, intersecting near the middle of the tumor. The cut surfaces are almost uniformly of yellowish-white color, looking much like the cut surface of tuberculous glands, but the substance is not the typical caseous matter of tuberculosis. Running irregularly in various directions are bands of fibrous tissue from five to twenty-five millimetres in breadth. The tissue which gives the reddish color of parts of the surface of the liver is only a very thin layer one-fourth to one and one-half centimetres in thickness. The consistency of the tumor does not differ greatly from that of normal liver-substance; if anything, it is softer.

Blocks of tissue of various sizes were hardened in corrosive subli-

mate, dehydrated, infiltrated with paraffin, and sectioned. On account of the extensive caseous changes present in the specimen, the preliminary preparation and sectioning were attended with unusual difficulties. The tissue was extremely friable, falling to pieces even with the most careful fixation to the slide. Sections were stained in carmine, Mayer's carmalum alone, and with picric acid; hæmatoxylin, hæmatoxylin and eosin, hæmatoxylin and picric acid; toluidin blue alone followed by differentiation with Unna's glycerine-ether mixture and with stryon, and toluidin blue with eosin; thionin; Unna's polychromatic methylene-blue and differentiated with stryon or glycerine-ether; Unna's alkaline methylene-blue; and for tubercle bacilli with carbol-fuchsin, aniline-oil-gentian-violet solution; Weigert's method for fibrin; and the usual bacterial stains. The best results were obtained with the polychromatic methylene-blue, toluidin blue and eosin, hæmatoxylin and picric acid, and particularly good differentiations in Mayer's carmalum followed by picric acid.

For convenience in description, the sections from different parts of the tumor will be reported upon as follows:

(1) From the periphery of the tumor near the point where it was removed from the adjacent tissue. But very few sections could be obtained from this part of the tumor for two reasons. In the first place, the degenerative changes, caseation, etc., extend suspiciously close to the margin of the growth, and, second, most of the normal liver-tissue adjacent to the tumor has been destroyed by the actual cautery. However, a few sections were obtained which show a small amount of uninvaded liver-tissue adjacent to the tumor. In these sections the liver-cells are intensely bile-pigmented, there is some dilatation of the intralobular vessels, a few areas of cell-necrosis, and a varying amount of lymphoid infiltration. The bile-pigmentation is generally distributed with a fair degree of evenness throughout the lobule. The round-cell infiltrate is, for the most part, restricted to the interlobular connective tissue, although at points the periphery of the lobule may show a few lymphoid cells around the blood-vessels. The intralobular necrotic spots contain cellular detritus, extremely granular, taking an acid dye with intensity, although showing, distributed throughout their structure, a few intensely basophilic granules. The areas of necrosis in the lobule vary in size from involvement of a few liver-cells to areas which occupy nearly or quite half the lobule; a very few are larger. None of the necrotic points examined show the presence of fibrin by Weigert's stain. The margin of the tumor, where it joins the normal liver, is sharply differentiated by a line of fibrous tissue varying in thickness. For the most part this fibrous wall measures between one-tenth and one and one-half millimetres in thickness. While largely made up of fibrous connective tissue, it shows a few unstriped muscular fibres, and a small amount of lymphoid tissue on the tumor-side of the wall. Immediately adjacent to this wall begins the extensive necrotic change which permeates the whole tumor. It would seem that fully 80 per cent. of the tumor mass, if not more, is made up of cellular detritus, caseous, or hyaline material. This extensive necrotic change is almost as marked near the line of separation from the normal liver-tissue

as in the central part of the tumor proper. Along the margins of these irregularly caseous areas, varying in size from twenty to thirty microns to nearly two centimetres in diameter, is found a connective-tissue stroma so arranged as to form irregular alveoli, the walls of which are lined by irregular, atypic, columnar epithelial cells. The majority of these columnar epithelial cells are of the high variety, and have their nuclei placed at the base of the cell, next to the connective-tissue wall. This rule, however, is not constant, as many of the alveoli contain low, columnar epithelial cells with the apex of the cell towards the connective-tissue matrix, and the nucleus at the other end of the cell. In the midst of the necrotic areas will be found small islands made up of similarly arranged elements.

(2) Sections from the central portion of the tumor. Here the change is most marked. The necrotic areas here, as elsewhere, are made up mostly of acidophilic detritus, containing a few intensely basophilic granules irregularly disseminated throughout the structure. Here more than elsewhere we see an irregular growth of the cylindrical epithelial cells with remarkable difference in size, shape, and nuclear characteristics as well as arrangement. Occasionally tubules are found which cannot be differentiated from the tubular arrangement constantly observed in malignant adenoma. The fibrillated connective tissue which forms the stroma contains, in this area, more lymphoid cells than are found near the periphery of the tumor. There are still recognizable a few spindle-cells with long, rod-shaped nuclei, apparently unstriped muscle-cells. The bands of connective tissue not uncommonly extend long distances into the necrotic material, and at points apparently divide the necrotic area into series of alveoli resembling those which in other parts of the tumor contain irregularly formed cylindrical cells, to which reference has already been made. At points in this part of the tumor small areas of hæmorrhage, irregular in size and evidently of different ages, will be recognized. Many of the points of hæmorrhage are evidently old, with extensive, almost complete, fragmentation of the erythrocytes and with an excess of leucocytes in the area involved. Some of the blood-vessels show minute ruptures, and in others the endothelial lining is swollen; an occasional longitudinal section of a blood-vessel will be seen, showing an irregular varicosity. In the tumor-tissue proper we have not been able to demonstrate the presence of any hepatic element unless we consider the irregular tubular structures, occasionally to be detected, residual bile-ducts, or the epithelial cells, the result of proliferative processes in the bile-duct epithelium. Occasionally will be found a necrotic area suggestive, in contour, of a liver-lobule, but similar areas are found which contain the irregular cylindrical cells already described.

(3) Sections from the periphery of the tumor. The hepatic capsule is thickened at nearly all points. In a few areas, immediately beneath the capsule, islands of liver-tissue may be found. These islands of liver-tissue show considerable bile-staining and slight infiltration by fat. The hepatic cells are not uncommonly intensely granular, some of them fragmented, and many scarcely identifiable as liver-cells. Many of the capillaries show swelling, desquamation, and fragmentation of the endothelial lining at

many points. A few show a distinct hyaline strip along the wall apparently just external to an internally displaced intima. The necrotic areas vary in size from a few hepatic cells to five, ten, or fifteen millimetres in diameter, while some areas are considerably larger; here, as elsewhere, they do not take the stain for fibrin. Just under the capsule, at a number of places, are found slightly dilated veins, many of these packed with red blood-cells; some of the vascular plugs are evidently old. The lymphoid cells are particularly abundant in the tissue immediately beneath the capsule, whether such tissue be a remnant of hepatic structure or the marginal zone of the cancerous growth.

A few areas within the tumor show papillomatous-like extensions forcing themselves into the necrotic areas, or it may be they are residual elements which have escaped destruction by the extensive necrotic change which surrounds them.

Irregularly disseminated throughout the tumor and, so far as can be determined, without any connection with its growth, are found a few mast-cells. Plasma-cells are present but not abundant.

Efforts to demonstrate the presence of echinococcus hooklets, coccidia, or other parasitic factor were uniformly unsuccessful.

Bacteriology.—Inoculations were made on blood serum, agar-agar, gelatin, bouillon, and urine agar, with negative results. Attempts to demonstrate the presence of bacteria in the sections were uniformly unsuccessful. Careful search was made for blastomyces and for coccidia, with negative result.

Diagnosis.—On first examination of the tumor and before an opportunity was afforded to examine sections from the adjacent liver-tissue, the small amount of cylindrical-cell element present led us to consider the growth as possibly one of the forms of granulation tumor. After a most careful and detailed study of a large number of sections from all parts of the tumor, we have come to regard it as a cylindrical-cell cancer. The unusually extensive necrotic changes are in our experience quite unique; we have never before observed a cancer showing such an almost universal necrotic process.

The table of seventy-five cases of resection of the liver for tumors was compiled by Drs. H. H. Cushing and M. L. Downs.

[For the first twenty cases, see the *Boston Medical and Surgical Journal*, April 28, 1892. For Cases 21–59, see the *Pennsylvania Medical Journal*, Pittsburg, October, 1897.]

TABLE OF SEVENTY-SIX CASES OF RESECTION OF THE LIVER FOR

For the first twenty cases, see the Boston Medical and Surgical Journal, April 28, 1892.

No.	Reporter and Reference.	Sex.	Age.	Duration, Nature, and Size.
60	Bobroff, Khirurgia mosk., I., 511-15; in Centralbl. für Chirurgie, 1897, p. 1115.	F.	25	Four months. Echinococcus alveolaris, lower edge of liver. Tumor, 14 cm. in diameter; weight, 200 grms.
61	Ullmann, Wien. med. Wochenschr., 1897, Nos. 47-52.	F.	54	Symptoms 14 days. Carcinoma of gall-bladder, hepatic duct, and neighboring parts of liver. Tumor of liver, 11½ cm. long, 9 cm. wide, and 4 cm. thick. Gall-bladder, 17 cm. long, 9 cm. wide, containing 51 stones.
62	Depage, Gaz. hebdom. de Méd. et de Chir., March 13, 1898.	F.	22	Five years. Hydatid cyst in quadrate lobe and three others in left lobe, all size of fist.
63	S. White, Brit. Med. Journ., 1897, II., 398.	M.	17	"Some time." Hydatid cyst, under surface of left lobe. Size of cocoanut.
64	Martin, Birmingham Med. Rev., XLIII., 1898, p. 92.	F.	36	Twelve years. Swelling, size of 6 months' pregnancy. Accessory lobe.
65	Lapointe, Le Bull. Méd., 1897, p. 883.	F.	34	Two tumors, each larger than two fists. Carcinoma.
66	Parker, Lancet, 1899, I., p. 301.	M.	29	About 5 months. Swelling 2 inches wide, below liver dulness. Gumma.
67	Palleroni, Gaz. hebdom. de Méd. et de Chir., 1898, p. 805.	F.	55	Tumor noticed about a year. Size of a turkey's egg. Hydatid cyst.
68	Jacomot, Bull. de la Soc. Anatom., 1898, p. 516.	F.	. . .	Four months. About 10 mm. in diameter. Hydatid cyst of liver, having pedicle.

TUMORS. COMPILED BY DRs. H. H. CUSHING AND M. L. DOWNS.

For cases 21-59, see the Pennsylvania Medical Journal, Pittsburg, October, 1897.

Method of Removal.	Treatment of Liver-Stump.	Result.	Remarks.
Excision. Tamponed with iodoform gauze. Floor of excision still of tumor-substance.	Extraperitoneal.	Recovered in 40 days. Later recurrence.	Two previous labors were followed by evident parametritis and swollen inguinal glands on right side.
Ligation and resection of ductus hepaticus and cysticus. Excision of tumor and gall bladder. After trying ligation, Paquelin's cautery, and pressure, bleeding finally stopped by folding liver on itself in direction opposite to course of blood-vessels and packing.	Extraperitoneal, with drawing up of duodenum for later hepato-duodenotomy.	Partial recovery; after 2 to 3 months; icterus, recurrence, and death.	Three stones wedged in cystic duct. No secondary growths. Daily escape of 400 to 900 grammes of bile for 3 to 4 weeks.
Incision across rectus abdominis. Resection of part of left lobe with Paquelin's cautery. Cyst in quadrate enucleated; packing; drainage-tube.	Intraperitoneal.	Recovered in 15 days.	At first, infection with colon bacillus. Small fistula, which closed later.
Adhesions separated. Cyst excised at base. Closure with 6 deep silk sutures. Hæmorrhage stopped by pressure.	Stump returned to peritoneal cavity.	Recovered in short time.	Cyst dark red, looked like malignant tumor during operation.
Pedicle ligated. Gall-bladder cut away with mass.	Intraperitoneal. Abdominal incision closed with interrupted silkworm gut. No drainage.	Recovery.	Thought to be cyst of kidney. Was accessory lobe. Contained liver-cells but no ducts. Some cells resembling sarcoma.
Pedicle clamped and tumor removed.	Extraperitoneal. Stump fixed in abdominal wall and clamps left on.	Death on 3d day.	Metrorrhagia for about a year led to diagnosis of uterine fibroid. Diagnosis: primary cancer of liver.
A third of gumma was cut away, and the margins of the liver wound sutured.	Intraperitoneal. No drainage.	Recovery.	The partial removal with anti-syphilitic treatment caused complete recovery.
Tumor dissected from gall-bladder. A cut made through liver 1 cm. from border of tumor. Silk threads passed through liver to hold it to abdominal wall. The tumor was then cut out from the liver-substance with scissors. Hæmostats and ligatures controlled hæmorrhage. Liver wound sutured and the abdominal wall closed.	Intraperitoneal. No drainage.	Recovery.	Diagnosis lay between floating kidney and hepatic tumor. Walls of cyst about $\frac{1}{2}$ cm. thick and partially calcified.
Pedicle clamped and tumor cut off.	Clamps allowed to remain 48 hours. Abdominal walls closed.		The thick cyst wall prevented fluctuation being felt. As it was attached to the posterior surface, it was difficult to diagnosticate and remove.

TABLE OF SEVENTY-SIX CASES OF RESECTION

No.	Reporter and Reference.	Sex.	Age.	Duration, Nature, and Size.
69	Winiwarter, Rev. de Gyn. et de Chir. abdom., 1897, Vol. I., p. 1088.	F.	50	Six months. No tumor could be felt. Diagnosis: carcinoma of gall-bladder.
70	Müller, Verhandl. d. deutsch. Gesellschaft. f. Chir., 1897, XXVI., 137.	F.	"Young"	Appearance during gestation. Angiosarcoma, size of fist, bluish, and covered with dilated vessels.
71	Müller, <i>ibid.</i> , p. 139.	F.	. . .	Six years. Cystadenoma (multiple cysts size of pea to fist).
72	Robson, Brit. Med. Journ., 1898, II., 1300.	F.	54	Twelve years. Acute symptoms, 4 months. Epithelioma of gall-bladder, cystic duct, and liver-substance. Gall-stone. Large tumor.
73	Heidenhain, Rev. de Gyn. et de Chir. abdom., 1897, I., p. 1091.	F.	61	About 8 months. Tumor small and irregular in outline. Carcinoma.
74	Monks, Boston Med. and Surg. Journ., April 6, 1899, 329.	F.	36	Only known for 5 weeks. Carcinoma of gall-bladder, involving a portion of the liver and the stomach.
75	Loux, present paper.	M.	31	Hydatid cyst.
76	Keen, present paper.	M.	50	First symptoms only 3 months before operation. Carcinoma. Size, 14 cm. long, 11 cm. broad, 7.5 cm. thick.

OF THE LIVER FOR TUMORS.—*Concluded.*

Method of Removal.	Treatment of Liver-Stump.	Result.	Remarks.
Silk threads introduced at some distance from gall-bladder and tied. Liver-substance incised with thermo-cautery. The bladder, cystic duct, and infiltrated portion of liver removed.	Packed with iodoform gauze and remainder of abdominal incision closed.	Died 6 weeks after.	Cancer; primary in gall-bladder and extended to liver. Calculi were found in the gall-bladder.
Strip of gauze thrust through under tumor, cut, and tied on each side. Then excision. No hæmorrhage. Ligation of vessels.	Extraperitoneal.	Recovery.	After 7 months' involvement of right clavicle. Death 2 months later.
Tumor drawn out. Wedge, size of fist, excised. Many cysts thus opened.	Extraperitoneal, for purpose of operating again.	Died in 11 days.	Death evidently caused by pulmonary embolus.
Tumor drawn out; tourniquet of rubber tube applied under knitting-needles thrust through below involved tissue. Tumor, gall-bladder, and cystic duct excised. Arrest of bleeding by pressure and catgut ligatures.	Extraperitoneal. Needles and superficial tissue sloughed away within a month.	Recovery.	Flow of bile for 10 days after slough separated. Nine months later recurrence and death.
A portion of the liver, 10 to 12 cm. long, removed with gall-bladder. Lembert's sutures were introduced in liver, and incision covered with peritoneum.	Intraperitoneal.	Recovery.	Very little hæmorrhage. Bladder contained one large and many small calculi. Recurrence at end of 3 months.
Presumably with knife; edges united by catgut.	Intraperitoneal.	Recovery.	Partial resection and suture of stomach.
Thermo-cautery.	Intraperitoneal.	Recovery.	Will be fully reported hereafter by Dr. Loux.
Thermo-cautery.	Intraperitoneal. Gauze packing.	Recovery.	Weight of tumor 1 pound and 5 ounces.

THE SURGICAL TREATMENT OF NEOPLASMS OF THE LIVER.¹

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HEPATIC neoplasms are sufficiently rare to make it advisable to put on record the following case:

B. T., colored; a female, aged thirty; married; the mother of two healthy children. After the birth of these children had two miscarriages at two months; had suffered from skin-disease, especially scabs on the knees and elbows; also from sore throat, which was pronounced syphilitic. Hair has never come off.

For the last three years she had suffered from dizziness, headache, and fulness and heaviness in the cardiac region; also from chills and fever and repeated attacks of vomiting, which were very constant, and came on at any time during the day. emaciation has been progressive, and now patient weighs about ninety pounds.

At the beginning of December, 1897, she noticed a soreness and heavy feeling in the pit of the stomach, associated with pulsation (beating) and vomiting, especially after meals. The vomited matter consisted of food and occasionally bile, but, otherwise, had about it nothing peculiar. Examination revealed a hard, tender mass in the pyloric region of the stomach, which moved somewhat with respiration. It could not be satisfactorily palpated, but appeared nodular, and could be moved slightly from side to side and from above downward. It appeared to be about the size of a tangerine orange. Percussion over it revealed a semitympanitic note, which appeared to be entirely different from that elicited over the liver. The liver dulness was normal, and percussion of the lower border revealed a perfectly regular line running from

¹ Read before the Texas State Medical Association, May, 1899.

side to side. The patient was rather thin and the abdominal aorta could be seen and felt distinctly. The growth did not pulsate and had no connection with that vessel.

Examination of the gastric juice, after a test meal, revealed absence of hydrochloric acid.

Suspecting the presence of a tumor of the pylorus, I advised an exploratory incision; and on January 17 opened the abdomen by a median epigastric incision, reaching from the ensiform cartilage almost to the umbilicus. The tumor at once presented itself, and was found to be attached to the liver and not to the stomach, which, on examination, was found healthy. The growth was about the size of a tangerine orange, and occupied contiguous parts of the right and left lobes, the suspensory ligament coursing over the surface. It was slightly nodulated, very hard to the touch, not pedunculated, and appeared to infiltrate the liver substance. Careful examination of the liver failed to reveal the presence of any other nodule. Excision was decided upon.

The suspensory ligament was very carefully divided on either side of the growth and the mass pulled into the abdominal wound. Two hat-pins were now made to transfix healthy liver tissue from lower to upper surface and at right angles to one another. A piece of rubber tubing was now fastened on the proximal side of the pins to restrain the hæmorrhage. The tumor was then removed with curved scissors. Two outlying processes were cut through, and they were carefully dissected out of the stump. The new growth was excessively hard, and gave one the feeling of cutting through schirrous cancer or scar tissue.

The pedicle was then carefully sutured into the abdominal wound and dressed with iodoform gauze.

The patient suffered very little from shock, but pain was severe for some days. Vomiting was not troublesome, and convalescence was uneventful until it became necessary to dress the wound and remove the rubber tubing and hat-pins. The tubing was removed on the seventh day and the pins at the end of the second week. The pedicle, which was gangrenous, was redressed with the greatest care, but in spite of this became infected. A suppurating sore resulted which prolonged convalescence for almost six weeks. Healing was eventually satisfactory, but with a wide separation of the recti muscles and an incipient abdominal hernia.

Microscopic examination showed a typical gumma, with a few giant-cells scattered through the growth.

A retrospective view of our case is very instructive. First, as to diagnosis. The syphilitic history, which has been so clearly set forth in the case, was carefully concealed by the patient, and was only elicited when a microscopic examination of the growth showed, beyond all doubt, that the neoplasm was a gumma. The evidence seemed to point to a malignant growth of the pylorus, the only point against this conclusion being the age of the patient. Again, the physical signs seemed to show that the swelling was semiresonant, and had a distinctive percussion note unlike that of the liver, which seemed to have a normal relation. In many cases a tympanitic zone has been found between the tumor and the liver, but at operation continuity has been perfect. (See list of cases, Terrier et Auvray, *Revue de Chirurgie*, Nos. 8, 13, 18, 22, 27, 32.) This fact has led to many erroneous diagnoses. Thus in Eiselberg's case of angioma the diagnosis was an omental tumor. Israel thought he had a renal tumor and found a very vascular sarcoma. Keen thought he was dealing with a floating kidney and found an adenoma.

Symptoms of Hepatic Neoplasms.—The symptoms of a neoplasm vary within great limits; at first they are vague, being ushered in with dyspeptic troubles and a sense of weight in the epigastric region. Stomach trouble may preponderate (as in our case) where vomiting and emaciation were marked, or, on the contrary, they may be absent from first to last. Later on there is an increase in the size of the liver associated with pain. The pains may be dull, or sharp and lancinating, radiating to the shoulder of the side affected. As the liver enlarges respiratory movements may be interfered with or the abdominal organs crowded and hampered in the proper performance of their duties.

The enlargement of the abdomen varies much. There may be marked swelling in the right hypochondrium, and the tumor may project below the costal margin to any extent. As-

cites may occasionally be present and the tumor may be marked. At times the descent and ascent of the tumor during respiratory movements may be very manifest.

Palpation may determine all the outlines of the swelling, the presence of nodules, fluctuating spots showing cysts, movements up and down during breathing, and its mobility or intimate connection with other organs.

The feel of the tumor is often very deceptive. Tense cysts rarely give a clear sense of fluctuation. Fluctuation may be present in cystic degeneration occurring in tumors or in abscesses. Occasionally a tumor may have a great range of mobility, as in Bergmann's case. Percussion usually determines a dulness which is continuous with that of the liver, although in many cases a distinct resonant zone exists between the two, as above mentioned.

Diagnosis.—The diagnosis is usually very difficult. Almost all the earlier cases were diagnosed as affections other than those of the liver. An analysis of the cases is very instructive on this point. Segond thought he had to deal with an ovarian cyst; Bastianelli with a kidney tumor; Bergmann with a renal tumor or a hydatid cyst of liver; Bruns with a cancer of the omentum; Elliot was doubtful between a sarcoma of the kidney and a tumor of the liver; Eiselberg with an omental tumor. Out of forty cases analyzed carefully by Terrier, in only twelve was an hepatic neoplasm certainly diagnosed, and in some of these the diagnosis was very guarded. Our own case has a parallel in that of Poirier et Chaput, where pyloric stenosis was diagnosed, and in which a small cancerous nodule was removed from the liver. The case recovered, but died six months later, and the primary cancerous growth was discovered at the lower end of the œsophagus.

Treatment.—This may be considered under two heads: (1) As to indications; (2) as to the best method of removal.

Indications.—Certain neoplasms should never be attacked surgically. These are secondary carcinoma and tuberculosis. The only exceptions to this rule are palliative operations, which in secondary cancer would aim to relieve distention of the gall-

bladder and in tubercle, to evacuate an abscess which was causing trouble by extension.

In primary cancer, the question of removal can only be determined by ocular inspection, revealing a single growth in an accessible situation. Even then other foci not visible during the operation may be present, and ultimately prove fatal. In all doubtful cases exploratory operation should be undertaken with a view to removal, if the conditions are found suitable.

The question of accessibility is an important one. This will largely depend upon the situation of the growth. One occupying the greater part of the right lobe had better be abandoned, unless the operator has mastered fully the technique of preventing loss of blood. Even then the immediate danger must be enormous, and the remote not less formidable. On the other hand, the left lobe may be dealt with boldly. Tricomi reports a case of the removal of the whole left lobe ("Adenoma of the Liver"), where, to accomplish this feat, he resected the xiphoid cartilage, cut across the rectus muscle, detached the left coronary hepatic ligament from the diaphragm, and so was enabled to deliver the whole lobe through the abdominal wound, and to remove it with the elastic ligature.

The question of pediculation of the tumor is an important one. In fourteen of forty cases reported by Terrier the tumors were pediculated, and this facilitated removal to a great degree.

Method of Removal.—This must, of course, vary with every case. Palliative operations have been performed in many cases, such as cholecystotomy, to relieve pressure on the biliary ducts (Jawadynski, Tuffier), or, again, a cystic cavity has been punctured, drained, and swabbed out (Routier). These operations all have their legitimate place when the case is not suitable for total removal.

Curative operations are undertaken whenever possible. In some cases the procedures are very simple, and consist in simple removal of the affected part with a knife (Jacobs), or the thermocautery at a dull red heat (Bruns). It is, however,

rarely that the tumors are so small as to allow this procedure only to be done. In larger tumors hæmorrhage is an important factor, and would certainly prove fatal unless means to prevent it were at hand. These means we have in the following measures:

(1) *Gauze Tampons*.—One cannot speak too highly of tamponing, although it would appeal more to us as an aid to prevent hæmorrhage after ligature than as a certain substitute for a ligature. In two cases—viz., those of Mikulicz and Schmidt—the tumors were removed with a curette, and the raw surface tamponed to prevent hæmorrhage.

(2) *The Thermocautery*.—Used at a dull red heat, the thermocautery, in cutting its way through liver tissue, will cause a very little hæmorrhage. One is, however, struck with the fact that, in all the cases where it has been used, the operators have been forced to control the hæmorrhage with either tampons or ligatures (Eiselberg). Usually, after hæmorrhage has been controlled by a circular ligature placed around the pedicle, the thermocautery is used to complete the section. *As a reliable hæmostat, as far as the larger vessels of the liver are concerned, it is practically useless.*

(3) *Ligatures*.—These may be of various kinds: (a) Elastic; (b) of silk, and the latter may be used in two ways: (1) Either to construct large areas of liver tissue, as in pediculated tumors, or (2) to secure the vessels on the surface of the liver section.

(a) The elastic ligature may be employed where the pedicle of a tumor is large, in which case it embeds itself into a groove in the liver substance, or, it may be used to construct a large portion of liver, being prevented from slipping by the insertion of pins through sound hepatic tissue. In both cases the tumor growth is removed by incision, made either with a cutting instrument or thermocautery, through normal liver tissue and the pedicle brought into contact with the abdominal wall, and fixed there. The most efficient elastic ligature is a rubber catheter (No. 9).

Although many cases have been treated by means of the

elastic ligature, it is always deplorable to be forced to treat the pedicle outside the abdominal cavity, for two reasons: First, it is a clumsy method, and tends to keep the recti muscles apart, and predisposes to abdominal hernia; and, secondly, because sooner or later the gangrenous pedicle will become infected, and tedious suppuration will result. One can only look upon a pedicle so treated as a sign of defective technique, and it is easy to prophesy that we shall soon look upon it in the same light as the extra-abdominal treatment of the pedicle in hysterectomy. The intra-abdominal treatment is then our aim, and it will now be my pleasure to explain how this can be attained.

(b) *Silk Ligatures*.—The problem of suture of liver substance has been carefully studied by many observers, and we seem now to have reached a conclusion that large portions of liver tissue can be excised without risk of death from hæmorrhage. Any method of treating the hæmorrhage which is not perfect in its action must be accepted with reserve, because in all the cases that form the basis of this paper only two deaths are directly to be traced to hæmorrhage, and, when we consider that very many of the tumors were removed without previous cognizance of their nature, this fact is little short of marvellous.

Pediculated Tumors.—Where the pedicle is narrow it may be surrounded with a single ligature and the mass cut away. If a sufficiently broad ligature is employed, it will embed itself into the liver substance deeply enough to prevent slipping, and still will not cut through the larger hepatic vessels. If the pedicle be so large as to be unsafe when secured with only one ligature, it may be transfixed with a blunt pedicle-needle, and tied in two halves, like the pedicle of an ovarian cyst.

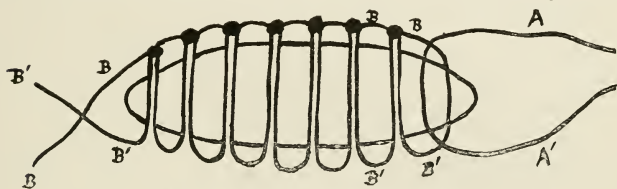
Non-Pediculated Tumors.—Cecherelli and Bianchi suggested a form of suture which has for many years been employed to strangle large nævi. To prevent the sutures from crushing into liver substance, the free ends were passed through

holes in a flat rod of decalcified whalebone and knotted over this.

Kousnetzoff and Pensky have used much the same form of substance without the whalebone. Both sets of observers met with success, and found that they could pull the sutures quite tightly without fear of tearing the large hepatic vessels.

Lastly, Terrier and Auvray have planned a form of suture which seems to promise great success in man. Experimentally in their hands it was quite successful, and I have personally proved by experiments on dogs that the method advised by them is perfectly reliable.

The method is as follows: Commencing about one centimetre from the free edge of the liver, far enough on the proximal side to insure thorough removal of the growth, a blunt pedicle-needle is passed from front to back through liver



Method of ligation in hepatic neoplasms.

substance. It is now threaded with the thickest, flattest silk obtainable, and withdrawn carrying the thread with it. The needle is now unthreaded and the loop (which we will call *A A'*) left untied. The needle still unthreaded is now passed from the under to the upper surface, penetrating and emerging a little nearer the free edge than the first thread. It is now threaded with another long silk thread (*B B'*), one end of which (*B'*) is drawn back by the needle to the under surface, while the other end (*B*) is left on the upper surface. The two ends (*A* and *B*) are now crossed, so that, if the loops (*A A'* and *B B'*) were forcibly pulled out of liver tissue, they would be entangled. We now commence the real suture.

The needle threaded with *B*¹ is made to penetrate the liver from the lower to the upper surface one centimetre from the

last puncture of the same thread. As soon as it emerges from the upper surface the loop is seized and held in place while the needle is withdrawn to the under surface, carrying with it the free end B' . The loop is then securely fastened to the end B by a double knot, which lies on the upper surface. In tying this knot one uses as much force as possible, only desisting when the loop can be no longer tightened. The liver parenchyma is torn and bruised, but does not bleed, while the larger hepatic vessels are not torn, but securely ligated. By dragging on the end of the thread B' the slack of the loop is drawn to the under surface. Another puncture is now made from below upward, the loop drawn up as before, the needle withdrawn carrying the free end B' , the loop knotted firmly to the thread B , and the slack hauled in as before; and so on until the growth is completely circumscribed and the threads B and B' are within one centimetre from the free edge of the liver opposite the starting-point. The two ends B and B' are now firmly knotted. The ends A and A' are also firmly knotted on the opposite side, and the preliminary ligature is completed.

It is better to place this suture in the form of an angle, so that when the tumor is removed the resulting wound may have steep sides, which can be sutured together afterwards.

Important points about the method are the following:

(1) *Always employ a blunt needle.* A sharp one is particularly liable to puncture the larger hepatic vessels, while a blunt one will usually pass on one side without wounding it. Terrier, in a case operated on by him, employed an ordinary blunt needle, such as is commonly used in transfixing the pedicle of an ovarian cyst. Experimentally, however, he has employed and strongly recommended a long, flattened, blunt-pointed needle of the Reverdin pattern. On the dog I have used an ordinary abdominal-wall needle, blunted at the point and edge, and have found it to work satisfactorily.

(2) *The sutures must be tied with sufficient force.* At first one is usually afraid to pull hard enough, with the result that the hepatic arteries and the portal vessels in the centre are not compressed and bleed quite freely, necessitating ligature.

We must pull with force enough and cut through the parenchyma of the liver, and if the ligature is coarse enough, the vessel will not be divided but only compressed. Terrier's original description (*Revue de Chirurgie*, Août, 1898, pp. 714 and 719) is quite emphatic on this point: "On exerce sur chacun d'eux [the ligatures] en serrant une traction *lente et continue*, pour qu'ils sectionnent le tissu hépatique compris dans l'anneau qu'ils forment. Les vaisseaux seuls sont pincés et rassemblés par la ligature; la déchirure hépatique ne saigne pas."

Again, in a case he operated on he remarks that each knot "*fût serrée aussi fortement que possible*, dans le but de déchirer toute la substance hépatique embrassée par elle, et de n'étreindre que les vaisseaux."

If any vessels still bleed on the raw surface, they can be seized with forcipressure forceps and secured by fine ligatures. This procedure is not difficult. It can easily be demonstrated on a dog's liver, and the ligatures have such a firm hold on the vessels that there is no fear of the loosening from the effects of arterial pressure. Experimentally, if a dog's liver, on which such ligatures have been placed, be removed and the liver vessels forcibly injected with fluid, the ligatures will not be forced off, but the vessels in the parenchyma of the liver will rupture first.

The method of passing the sutures described above differs somewhat from Terrier's description. It is surer than his, for it obviates repeated threading of the needle and insures the threads always following the same channels in traversing liver substance. Care must, however, be taken to pick up the loop on the proper side of the needle before the needle is withdrawn; otherwise the needle, instead of being attached to the free end of the thread, will be found entangled in the loop, and the puncture will require to be done over again.

ANALYSIS OF CASES AND RESULTS.

As far as I have been able to collect records up to the present, forty-seven cases of neoplasms have been operated on.

Terrier and Auvray's list of cases, which is quite com-

plete, consists of forty cases, in which thirty-eight complete operations were performed.

Complete operations performed	38 cases.
Primary carcinoma	7 cases.
Secondary carcinoma	1 case.
Sarcoma	4 cases.
Adenoma	6 cases.
Angioma	4 cases.
Doubtful tumors	3 cases.
Gummata	9 cases.
Biliary cysts (non-parasitic)	4 cases.
Incomplete operations performed in (cholecystotomy)	2 cases.
Cancer implicating gall-bladder	1 case.
Cancer (secondary to cancer of pancreas)	1 case.

Literature.—All the literature referred to is given in the exhaustive monograph of Terrier and Auvray, published in the *Revue de Chirurgie*, Nos. 5, 8, 9, 1898. The cases collected by me, in addition, are referred to under their descriptions. These number six in all, my own being added makes a seventh.

CASE I.—(Mayo Robson, *British Medical Journal*, October 29, 1898). —Primary carcinoma of the gall-bladder(?), implicating adjacent liver substance, associated with gall-stones. Patient, a married woman, aged fifty-four. Swelling on right side of the abdomen for twelve years diagnosed as a movable kidney. Liver reached level of umbilicus, and from its lower right border a firm, rounded tumor descended as far as the groin. Diagnosis of enlarged gall-bladder and gall-stones. Malignancy suspected. Operation revealed enlarged gall-bladder. Two ounces of bile aspirated and a small gall-stone removed. Walls of bladder infiltrated, and a tumor found at entrance of cystic duct; beyond this another stone, the size of a thrush's egg. Liver substance adjacent to gall-bladder occupied by extension of growth.

Operation.—Cholecystotomy and removal of affected liver accomplished by transfixing healthy liver with needles, and using rubber tubing as a tourniquet. Abdominal fixation. Rubber tube and needles removed within the month.

Result.—Immediate recovery from the operation, but death from recurrence about seven months later.

Microscopic examination unsatisfactory. Reported to resemble a sebaceous cyst.

CASE II.—(Mayo Robson, *British Medical Journal*, October 29, 1898). —Cancer of gall-bladder and cystic duct, implicating adjacent liver substance, associated with gall-stones. Patient, a married woman, aged fifty-

two, a sufferer from hepatic colic associated with jaundice. Liver enlarged and gall-bladder distended also.

Operation.—Removed four gall-stones from bladder; found an enlargement of cystic duct, and below this an impacted gall-stone. Adjacent parts of liver showed a nodule of cancer. The whole mass—part of liver, gall-bladder, and cystic duct—removed after transfixing by needles and controlling hæmorrhage by rubber tubing. Abdominal fixation. Tourniquet and needles removed in two weeks.

Result.—Immediate recovery, but patient died of recurrence in four months.

Microscopic examination revealed a carcinoma (no details given).

CASE III.—(Mayo Robson, *British Medical Journal*, October 29, 1898).—Carcinoma of liver and gall-bladder; gall-stones; implication of great omentum and colon. Patient, a married woman, aged fifty-two; had suffered from pain for fifteen months, extremely ill and jaundiced, showed an irregular hard and fixed tumor below the right costal margin.

Operation.—Found gall-bladder full of pus, epithelial *débris*, and gall-stones (230); adjacent liver infiltrated; colon, omentum, pylorus, and duodenum adherent and infiltrated. Separated gall-bladder and liver and removed mass by pins and tourniquet as above.

Result.—Death within twenty-four hours.

Microscopic examination not reported.

CASE IV.—(W. G. Spencer, *Lancet*, December 3, 1898).—Unmarried woman, in whom a tumor apparently connected with the liver gradually developed.

Operation.—Exploratory operation performed, and a gumma of the free edge of the liver discovered. This was fixed to the abdominal wall, and the mass scooped out, the cavity being filled with gauze.

Result.—Rapid healing under antisyphilitic treatment.

CASE V.—(W. G. Spencer, *Lancet*, December 3, 1898).—A middle-aged woman, with a large tumor growing from the liver, which was about to ulcerate through the skin. The mass was cut into and the contents scooped out. Healing under antisyphilitic remedies was rapid.

CASE VI.—(*British Medical Journal*, November 12, 1898).—A case mentioned by Rushton Parker, where he had cut down on a hepatic tumor, which proved to be a gumma, the mass was curetted and removed.

In addition to these Spencer (*loc. cit.*) and Clement Lucas (*Lancet*, December, 1898) each report a case where an exploratory operation was performed and a gumma discovered. Nothing was done but the abdomen closed and the patient recovered under antisyphilitic remedies.

Perhaps this is the best method to pursue in the case of gummata. Where they are multiple, it is certainly the only course to pursue. If single, the case may be left to the operator's judgment and skill. All gummata certainly do not yield to antisyphilitic remedies (*e.g.*, those in the central and nervous system), and, as it is impossible to be sure of this point, if removal is simple, it should be undertaken; if difficult, the treatment should either be curettement or closing up the abdominal cavity and trusting to medicines.

Results.—The most surprising thing about the reported cases is the small mortality,—*only six deaths*. One would naturally expect that deaths from hæmorrhage would have been frequent, and yet we only meet with *two cases*, that reported by Linz and Escher (*Centralblatt für Chirurgie*, 1887, No. 5) and that by Wagner ("Verhandlungen der neunzehnten chirurgischen Kongress," S. 9). Those from infection are preventable, and while instructive, need not concern us as necessary adjuncts to statistics.

As to the class of cases interfered with, an analysis of those attacked for malignant disease is rather discouraging. Secondary carcinoma of course should never be attacked. Primary cancer shows only one case,—that of Luke's,—which is encouraging. His patient was alive two years afterwards. In Jacob's case recurrence appeared in seven months; in Poirier's, in six months.

The cases diagnosed as adenoma are also interesting. In two—viz., those of Groubé and Triconi—death occurred from recurrence, one at the end of seven months and the other after three years. In both the recurrence took a typical carcinomatous form.

In the sarcomata, Elliot's case of alveolar sarcoma died three months after operation. Israel's case died in 110 days. That of Skifassowsky seems to have recovered.

RESULTS AND METHODS OF TREATMENT OF
COMPOUND FRACTURES AT THE J.
HOOD WRIGHT MEMORIAL
HOSPITAL.¹

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DURING the three years ending January 1, 1899, there were admitted to the J. Hood Wright Memorial Hospital fifty-five cases of compound fractures of the long bones. The cases of compound fractures of the bones of the head, hand, and foot have been omitted, as they are either of a minor nature, as a rule, or in a class by themselves. Nearly half the cases entered the hospital during my service, and many of the remainder came under my observation when I succeeded to the services of my colleagues. I have collated the histories with particular reference to the primary treatment of the wound, and its results. If the wound can be kept or made aseptic, the course of a compound fracture will not differ much from that of a simple one caused by an equal degree of violence.

Of the 55 cases all but one were males. Their ages varied between eight years and fifty-six years. Seven were between eight and twelve; 18 between twenty and thirty; 23 between thirty-one and forty; 6 over forty; and 1 unknown.

The upper extremity was concerned 12 times, the lower 43 times. The violence was applied directly in 33 cases, indirectly in 9, and in 14 while probably direct, this could not be determined from the history. The following table (I) shows these details more fully.

¹ Read before the New York Surgical Society, May 24, 1899.

TABLE I.

	Direct.	Indirect.	Undetermined.	Total.
Tibia and fibula	15	3	8	26
Tibia	6	1	1	8
Femur	4	2	0	6
Femur, internal condyle, by a bullet	1	0	0	1
Femur and sacrum	1	0	0	1
Pelvis	1	0	0	1
Lower extremity	28	6	9	43
Humerus	1	0	2	3
Humerus, external condyle	1	0	2	3
Humerus and ulna	1	0	0	1
Radius	0	1	0	1
Ulna	1	0	0	1
Radius and ulna	0	2	1	3
Upper extremity	4	3	5	12

For the purposes of this paper five of these cases have been excluded. Two were infected when admitted to the hospital, two days and six weeks respectively from the time of injury. Two left the hospital at their own request within twenty-four hours, and one was transferred to another hospital forty-eight hours after admission; and they have not been traced. There remain as a basis for this paper fifty cases.

The gravity to life of compound fractures, and the mortality from them can hardly be inferred from text-books. An erroneous impression is derived from statistics of compound fractures that include osteotomies, and simple fractures made open, where there is an opportunity to protect the wound from infection. When this is done, the resulting percentages are very much more favorable than any likely to be met with in practice, where no such precautions are possible, and the wound is often full of earth, stones, and other foreign bodies.

In any considerable group of cases of compound fractures we may expect to find (1) those that die of shock; (2) those that require primary amputation; (3) those that die of inter-

current or complicating disease or other injuries, the compound fracture itself remaining aseptic; (4) those that pursue an aseptic course and recover; (5) those in which our efforts to procure asepsis are unsuccessful and the wound becomes infected. Of the cases becoming infected, there is the set of very mild infections (or of late superficial infection of the wound) with speedy restoration of asepsis under proper measures. A second set of infections of moderate or great intensity, where recovery gradually occurs; and a third set where amputation or death occur.

Of these fifty cases, four of the tibia and fibula were submitted to primary amputation of the thigh, the extent of injury precluding any attempt to save the injured member. Of these cases of primary amputation, two in my service, healed by first intention; in one, in the service of a colleague, there was some infection delaying healing; in the fourth, in my service, there was death in less than twelve hours.

CASE XLV.—A. D., aged forty-five, fell under the rear truck of a moving car. On admission he was in profound shock and had lost much blood. The left tibia and fibula were crushed into small fragments from the knee to the ankle, the integument torn away from the inner side of the leg, and all the soft parts severely lacerated. There was also a scalp wound, but no fracture of the skull was made out. Amputation through the condyles was done when the patient had recovered from shock. His temperature rose steadily from 99° F., on admission, to 106° eight hours later, and he died nine hours after admission. I have been unable to find an account of the autopsy.

The three other cases died in less than twenty-four hours. They are

CASE XL.—F. K., both legs crushed by a freight train; died from shock in two and one-half hours.

CASE XLIV.—R. S., died in four hours of shock. Compound fracture of both femurs in lower third, several ribs broken, and liver ruptured.

CASE XLVI.—G. L., struck by a flying rock from a blast, and admitted in a state of shock. Five hours later, under ether,

the wounds of the left buttock were exposed and cleansed, incisions being made to facilitate treatment. There was an excavation, large enough to admit both hands, extending into the great sciatic notch, and extensive tearing and bruising of muscles, and extensive fracture of the pelvis. Wound packed with dry sterile gauze. The temperature rose from 99° F., on admission, to 104.2° before death, in twenty-three hours. The autopsy showed that there had been an internal hæmorrhage, and infection with the *bacillus ærogenes capsulatus* of Welch.

Of the total of fifty cases, nine died. The death in the four whose histories have been given may be attributed to shock or other injuries, and not to avoidable infection.

Three deaths, two of which occurred in my service and one in a colleague's, are not attributable to the infection of the wound. I shall give as succinctly as possible a few cases that seem important, but will not tax your courtesy nor burden this paper with the histories of all the cases upon which it is based, although many resulting favorably, and not reported, presented interesting features.

My colleague's case, of death not due to infection, was as follows:

CASE XIV.—C. F. fell eighteen feet from a ladder to the ground. Left tibia and fibula fractured one inch above internal malleolus, obliquely, with forward displacement of lower fragment, and protrusion of an inch and a half of tibia through a vertical wound two inches long on internal aspect of leg. No pulsation in posterior tibial artery. Two per cent. of albumen in urine. Under ether the wound was thoroughly cleansed and the fragments adjusted. No incision was made. A sterile dressing and fenestrated plaster cast were applied. Temperature, twelve hours later, 101° F., and ranged from 100° to 101° for two days, and delirium developed. Patient got out of bed and walked about. At the end of twenty-four hours the foot was swollen and cyanotic. Ether was again given, and three-fourths of an inch of the lower end of upper fragment cut off with bone forceps. The condition of the wound is not noted in the history. On recovery from ether there was violent delirium; the temperature rose to 105° on the third day, and to 107° on the fourth, when the patient died. The autopsy records of the hospital for several months are

lost, and in this case the only note in the history is that the autopsy, made by Dr. Harlow Brooks, "showed alcoholic brain."

My two cases were as follows:

CASE IX.—J. R., fifty-six years of age; knocked down by derrick loaded with heavy stone. Shock and multiple injuries. Simple fractures of shaft of left humerus, and left internal malleolus. Compound fractures of left tibia and fibula, and external angular process of frontal bone, with wound of left eye. The lower jaw broken in two places, ramus on left side, and in middle with a communicating wound of chin. Under ether my house-surgeon and I together attended to the various injuries as rapidly as possible. No incision was needed to gain free access to and irrigate the wound of the compound fracture.

It was drained, dressed aseptically, and with the other fractures put up in plaster. The lower jaw was wired in front and the wound packed with sterile gauze. Inhalation pneumonia developed, and death occurred in less than three days from the time of admission. The wound of the leg was not infected.

CASE XXIV.—J. M. C., aged twenty-two years. No alcoholism. One year ago had his first epileptic fit. Since then has had as many as seven a day; three occurred last week. First severe injury occurred the day of admission. While riding on the front platform of a street-car, talking to the driver, he suddenly lost consciousness, and remembers nothing more until he found himself on the ground with people caring for his leg, fractured at junction of middle and lower thirds. The tibia at this point was comminuted and connected with oval lacerated wound, one inch long, on inner side of leg. Fibula comminuted at same level, closed. Multiple wounds elsewhere.

Under ether wound enlarged, fragments of tibia loosened from periosteum removed, sharp bone edges made smooth, and torn tibialis anticus muscle sutured with fine catgut. Wound partially united with sutures; no drainage; large sterile gauze dressing, posterior guttered tin splint. For considerable oozing of blood wound at first dressed daily; no pus. The urine appeared free from albumen. No cause for epilepsy could be found. Temperature range ordinarily from 100° to 102° F. Sutures removed on sixth day. On eighth day an attack of petit mal, lasting about twenty minutes.

The day before death the temperature still ranged from 99° to 100° F.; there was no pain or sign of inflammation in the wound; urine reported free from albumen and sugar; patient on full diet. Two weeks after the receipt of the injury patient was comfortable and in good spirits; temperature, 100.4°; pulse, 90. While sitting up in bed after dinner, talking to the other patients, he threw himself or fell backward, became cyanotic, and died in ten minutes without any convulsion. The following abstract from the autopsy, made by Dr. Brooks, was recorded with the history:

Brain: Pia adherent and congested in places. Heart: Few areas of old pericarditis present. Right auricle and ventricle contain small amount of antemortem clot. Walls of coronary artery thickened. Kidneys: Capsules adherent; cortices thick; capillaries markedly congested; tissue granular; interstitial tissue much increased; pelvis congested.

Cause of death: Chronic nephritis and acute nephritis; nephritic coma.

Deducting the four cases of primary amputation, three of death in shock, and three of death just related, there remain forty cases from which to compute the percentage of success in the efforts to make the wound in compound fractures pursue an aseptic course.

Table II exhibits the seat and mode of infliction of the fractures.

TABLE II.

	Direct.	Indirect.	Undetermined.	Total.
Tibia and fibula	9	3	7	19
Tibia	5	1	0	6
Femur	2	2	0	4
Femur, internal condyle . .	1	0	0	1
Femur and sacrum	1	0	0	1
Lower extremity	18	6	7	31
Humerus	1	0	1	2
Humerus, external condyle	0	0	2	2
Humerus and ulna	1	0	0	1
Ulna	1	0	0	1
Radius	0	1	0	1
Radius and ulna	0	1	1	2
Upper extremity	3	2	4	9

Of these forty cases, twenty-three pursued an aseptic course; seventeen became infected. The infection was mild in six cases; moderate or severe in seventeen. In six a secondary or late amputation was done, with one death. One case died of sepsis and exhaustion without amputation.

The cases of compound fracture are usually brought to the hospital by the ambulance. The ambulance surgeon, at the scene of the accident, does not, as a rule, attempt to cleanse the wound nor the limb, and he does not reduce any displacement of the bones. He places a large pad wet with carbolic acid solution over the wound and applies proper splints. As soon as practicable after admission to the hospital the patient's wound is attended to in the accident ward or operating-room. If there is much shock delaying the first thorough dressing, a preliminary cleansing of the limb is made to prevent excessive infection while waiting, and a sterile dressing is applied.

The first dressing is done at times without an anæsthetic, but in rather more than half the cases anæsthesia was employed. Of the last twelve cases, admitted during the last nine months of last year, only one was cleaned and dressed primarily without anæsthesia, and yet only five of these cases recovered without some infection. But all were severe cases, and the wound excessively dirty in a number of them.

The employment of anæsthesia for the first dressing seems to me very important. The possibility of thoroughly scrubbing, curetting, cutting, and manipulating without producing pain, and the greater ease of so doing due to the relaxation of the muscles, leads to much more careful work. The danger is that one will be tempted to do more suturing of muscles, bone, or integument than is wise.

The cases that survive shock and do not require immediate amputation divide themselves into several groups as regards the treatment needed.

There are, first, a set of cases where anæsthesia is often unnecessary, or where it may be employed, if desired, and where a sufficiently good wound-treatment is obtained by a thorough disinfection of the skin and edges of the wound. No

incisions, no wound irrigation, no sutures, no drainage are required. The fracture may be due to direct or indirect violence, but the wound is fairly small, clean, and the injuries to soft parts very trifling. A sterile gauze dressing and such retentive apparatus as one would employ for a simple fracture are enough. My preference is for a light plaster case. Nine cases, six in my service, the others in my colleagues, were treated in this way, anæsthesia being employed only once. To this set I have added a tenth case, where the treatment differed only in that a bridge of tissue between two small wounds was cut at the first dressing. In all but two of these cases the wounds remained aseptic. My own infected case required but one other dressing. On the third day the wound was found surrounded by a small area of redness and a few drops of bloody pus. The wound was slightly enlarged, disinfected, and a sterile gauze dressing applied, and outside of this a plaster bandage, which was not disturbed for nine days, when the wound was healed.

My colleague's case was of a bullet-wound of the internal condyle of the femur. Within twenty-four hours the temperature began to rise and there was pain in the knee. Ether was given and the knee-joint drained by free incisions on either side of the patella. A week later the joint was widely opened by other free incisions, but the local infection persisted, the general condition of the patient was deteriorating, and the thigh was amputated about one month after the injury. The patient recovered.

There is a more serious group of cases where it is necessary to enlarge the wound, to irrigate or to drain. Theoretically one would like to remove all the tissues so bruised as to have their vitality destroyed or much impaired, to wash out, or inhibit the vitality of, all micro-organisms, to suture severed muscles, to retain bones in apposition by suturing, and in general to leave the wound in a condition approaching that of a wound of similar character deliberately made on the operating-table.

In a great many cases, if the damaged and probably in-

fectured tissues are removed with scissors and forceps, and the wound thus made aseptic, one will find that there is so much damage done to the limb that there is nothing left to save, and an amputation must be done. To limit one's zeal for asepsis within bounds that may save a serviceable limb, and endeavor to assist nature in combating the expected infection, is a wiser and more conservative plan than to try to leave the wound in a theoretically perfect condition. Just how far to go and when to stop in our operative treatment of these cases requires experienced judgment to lead to thoroughly satisfactory results.

No one thing, however, seems to be more unwise than primary suturing of bone or muscle. This was done in six cases. One is already reported. In four there was some degree of infection. A separate wound to reach and wire a tibia was made in one aseptic case in my service, and there was no infection. But bony union was not hastened, and did not occur for about five months, although the damage originally had not been very severe. In a very extensive wound of the arm associated with transverse fracture of the shaft of the humerus, in the service of a colleague, the torn inner head of the triceps was sutured with chromicized catgut. The wound was drained, infection was minimal, and the result brilliant.

In a third case, in a colleague's service, the patient had been run over by a dirt-cart, which broke the tibia at the junction of the middle and lower thirds, the fibula an inch and a half higher up. Two wounds over the fracture of the tibia, each about one inch long, were enlarged under ether. The muscles had been separated from the bone, the periosteum stripped up. There was a partially detached fragment of bone. A chromicized catgut suture was placed encircling these fragments, and the muscles and periosteum sutured, as well as the skin, except where a small gauze drain was inserted. The following day patient had a chill and rise of temperature. The wound was painful and the sutures were soon removed, and infection was severe for ten days and followed by necrosis and slow recovery.

Amputation was finally done in the other two cases in my service. The wound in the first case was ground full of sand. A

derrick had fallen thirty feet onto patient's leg, comminuting both bones, and causing extensive laceration and contusion of the skin and muscles. It was very carefully cleaned under ether, the torn muscles sutured, and the wound drained with iodoform gauze. No sutures were placed in the wound. On the following day the temperature rose to 102.6° F., there was a secondary hæmorrhage. The next day the temperature was 104° , the skin edges dark in color and swollen; the lower part of the leg and foot swollen and cedematous, and there was an odor of putrefaction. Patient refused consent to amputation, but allowed it the following day, and it was done by the house-surgeon at the knee-joint. The flaps became gangrenous, the temperature remained high, and two days later amputation higher up was done. Pneumonia developed, the second amputation wound became infected, and the patient died eleven days after the injury.

The last case of this group was of a man who fell five stories with a scaffolding, and received multiple wounds and fractures. The compound fracture was of the radius and ulna, two and a half inches from the wrist-joint, with a wound an inch long on the outer and anterior surface of the forearm through which the torn end of the flexor sublimis digitorum protruded. The wound was enlarged, bleeding points tied, and, under ether, cleansed, muscle sutured, and wound packed with sterile gauze, with no sutures of wound. The temperature rose and remained elevated. On the third day free incisions were made into the forearm, back and front, with thorough drainage. On the eighth day other sinuses were laid open and irrigated with peroxide of hydrogen and salt solution, and drained. Three days later a circular amputation of the forearm, two inches below the joint, was done. The wound became infected with streptococci, and three days later two doses of ten cubic centimetres each of antistreptococcic serum were given with no apparent result. Patient gradually improved, and left the hospital, five weeks later, nearly healed.

This group of six cases gives us then two amputations with one death; one case of necrosis; one of delayed union; and two good results; although one died of nephritis.

Where the injury is so severe as to tear muscles, the probability of successful suturing is small. When the damage to

surrounding parts is small, and suturing likely to lead to good results, it is seldom necessary.

There is less risk of infection in converting a simple into a compound fracture, when we can keep pyogenic bacteria out of the wound, than in suturing muscles and bone in a wound, already, perhaps, so contaminated with bacteria that under the best conditions for resisting inflammation, good circulation, absence of tension, and adequate drainage, infection is more than likely to follow. An exception should be made for cases where the injury is produced by a clean-cutting instrument.

In another set of nine cases the wound was sutured partially eight times, wholly once. In seven of these cases the wound had been enlarged under ether. In one, dressed without an anæsthetic, where the wound, two inches long, over the ankle-joint was not irrigated nor drained after the protruding tibia had been reduced, infection occurred and was marked at the end of four days. This case is the first of the series of fifty-five, and the only woman. She was thirty-five years old, and admitted on New Year's day, having fallen down a flight of stairs. On the 6th and 9th of January and 10th of February free incisions for drainage were made, and on the last of these days the loose internal and external malleoli were removed. February 20 the leg was amputated at the middle. A sinus followed, a necrosed fragment of bone was removed June 26, and the case was discharged well August 4.

Five cases remained aseptic.

In the seventh, in my service, the tibia had been broken by the kick of a horse at the junction of the middle and lower thirds. There was a splinter of loose bone, the periosteum was stripped up from the lower fragment, and the lower end of the upper fragment was displaced backward, and held in this position by the lower fragment. Fibula broken at same level, but not open. The temperature of patient was 100° F. Under ether wound enlarged, loose fragment of bone removed, deformity reduced, extremities of wound sutured, sterile gauze drain and dressing. Posterior tin splint. Wound next day was painful. The temperature for three days ranged from 100° to 101.4°; the pulse-rate not over

80. On the following day, no pain, no sign of infection, some oozing of blood, and a fenestrated case was applied. On the seventh day was allowed up in chair; began to have pain in leg. Thirteenth day, dressings are not stained. On the seventeenth day pain in calf of leg increasing, and on the eighteenth had a secondary hæmorrhage, controlled by pressure. On the twentieth day had another hæmorrhage, and my colleague, who had succeeded me, tied the posterior tibial artery. Two months after admission bony union was firm, but there was some necrosis, and the sequestra were removed four months after the injury was incurred.

The two other cases of this group, in the service of colleagues, did well. In one there were a few drops of pus at the fourth redressing, on the tenth day. On the twelfth day the wound was still further closed by secondary sutures. In five weeks there were good union and position of the tibia and fibula. In the other case, a boy of nine broke the radius and ulna by falling from a tree. The radius, "freely coated with splinters of wood, sand, and grass," projected an inch and a half through a transverse wound an inch long just above the styloid process on anterior aspect of forearm. During the next few days there was considerable discharge, soon foul smelling, and on the sixth day, under chloroform, a counteropening was made on the opposite side of the forearm, and thorough drainage instituted. In six days more the infection subsided. He left the hospital eighteen days after the injury, to return for further dressings. This group, then, gives eight satisfactory results out of nine cases, although, strictly speaking, infection occurred in four.

In the remaining sixteen cases no sutures were used. In nine there was no infection; in two the infection was trifling; in five serious.

In seven cases the wound was incised under ether and irrigated, and in four of these was drained. The results were, no infection in four cases; slight in one; and severe in two; one dying and the other recovering after amputation. Only

two of these cases, both aseptic, occurred in my service. In the case that died the infection was unavoidable.

CASE XLVIII.—J. G. D., aged thirty years, struck on back by locomotive engine of elevated railroad. Right femur broken just below trochanter, upper fragment directed forward, lower backward. Lacerated wound, one inch long, at apex of Scarpa's triangle, another two inches long just below ischial tuberosity. Transverse fracture of sacrum, gluteus maximus muscle ruptured, lacerated wound of scrotum, exposing testicle. Wounds covered with dirt; other wounds and abrasions. Shock treated. Then, under ether, wounds enlarged, sterile gauze drainage, and outer dressing, long lateral splint for thigh. Wound exposing testicle drained and sutured. Subcutaneous administration of one litre of physiological salt solution. Next dressing in two days, under ether; no discharge from wounds; temperature 102° F. Two days later, temperature 103° , dressed under chloroform. Scrotal wound healed well, but that of thigh became soiled by urine and fæces, a large pressure sore developed over sacrum, and patient died of exhaustion from sepsis in about seven weeks.

The case of amputation was Case XI. J. K., twenty-eight years old. Caught between bucket of sand and a hawser. Large lacerated wound, three inches long crosses left leg just below the popliteal space, with much bruising and laceration of muscles. Wound communicates with fracture at lower third of femur. Under ether, wound enlarged and cleansed; bleeding points tied; hot saline irrigation; sterile gauze drainage and dressing, and posterior splint. Two days later thigh, leg, and knee swollen. The temperature remained up, and on the tenth day thigh was amputated. Patient recovered.

In the remaining nine cases of the entire series, no sutures were used and no incisions made. All were carefully irrigated through the original wound, and drainage was employed in four. In three of these there was no infection, in the fourth a very late infection with the bacillus pyocyaneus, not interfering with the healing of the wound. One of the aseptic cases was my own, the other three were my colleagues'. A colleague had one other case in this set.

This case was a fracture of both thighs in the lower third, one simple, the other compound, with a wound five inches long on the

postero-external aspect and a large abraded area on the antero-internal aspect, and multiple minor injuries. The man, aged twenty-four, had fallen into a stone-paved basement from a fourth story window. The wound was dressed without anæsthesia. The next four days the temperature range was from 99.6° to 102.4° F. On the thirteenth day, under chloroform, an abscess cavity under the abraded area, which had been soiled by the patient's urine, was laid open freely, irrigated with Thiersch's solution, and packed with dry sterile gauze; and a sinus leading about four inches downward from the original wound was treated in the same way. Under daily dressings the infection promptly subsided. Six weeks after the injury there was firm union of the simple fracture, in good position. Three days later it is noted that there was firm union of the compound fracture, position fair, wounds almost healed. Nine weeks and three days after the injury the patient was able to stand unaided, and left the hospital about ten days later.

The remaining four cases were mine, and are all worth reporting, as they illustrate fairly the various conditions one meets with in these cases of compound fractures.

CASE VI.—J. M., aged six years, fell two stories through an air-shaft. Right femur fractured from above downward, and within outward, at junction of lower and middle thirds. Upper fragment projects through punctured wound on outer surface. Ether. Incision not noted; fragment of loose bone one by one-quarter inch removed, wound irrigated after sterilizing skin of thigh. Sterile gauze dressing, plaster spica. Temperature 100° F. at time of operation; rose one-half degree next day; came to normal on fourth day. On eleventh day first redressing; wound healing; new case applied. There was much trouble with the cases, which were frequently wet with urine and broke repeatedly. On the twenty-sixth day wound healed, considerable bowing and shortening of limb, which was refractured under ether and new case applied. Fifty days after the injury patient was walking about with good union and one-quarter inch shortening.

CASE VIII.—J. D., thirty-five years of age. Kicked on shin by horse. The leg was already deformed from a compound frac-

ture received ten years previously. Much contusion surrounding a wound three-fourths inch in diameter, over crest of tibia, where broken in middle third of leg. No ether; no incisions; skin cleansed; irrigation of wound with bichloride solution followed by saline; sterile dressing; plaster case. Next few days leg painful, temperature from 101° to 103.5° F. On the third, incision upward from wound, two inches long, relieving tension. Wound irrigated with saline solution; packed with iodoform gauze. Next day, elevation of temperature, and pain had subsided and did not return. On thirteenth day plaster case applied, and on seventeenth dismissed to return for further dressings.

CASE XXVII.—J. C., aged twenty-eight years; struck and thrown by cowcatcher of a railroad locomotive. Compound fracture of right tibia and fibula, three inches above ankle; two communicating wounds separated by a small bridge of tissue, one over anterior border of tibia, one inch long, the other one and a half inches long, over antero-internal aspect of leg, with tibia projecting through it. Temperature 100.4° F.; pulse, 96; respiration, 24; patient cyanotic. No ether; fragments removed; ends approximated; sterile gauze dressing; posterior tin splint, and an ice-bag applied over wound.

Two days later no redness; no discharge from wound. In five days from injury, wound at dressing looks well, not granulating rapidly. Temperature has ranged about 100° to 101° F.; blood shows malarial parasites. Nine days after admission, for first time wound suppurating. Three days later I had left the service, and the leg was amputated by the house-surgeon. There was some infection of this wound, and another amputation was done about two months later with prompt recovery.

CASE XIX.—J. J. W., aged forty years. A barrel of cement fell some distance onto his left leg and foot. Very oblique compound fracture of tibia and fibula five inches above malleolus. Simple fracture of third and second metatarsal bones, with large hæmatoma. Under anæsthesia, wound cleansed and irrigated without enlarging it; sterile gauze dressing; and plaster splint. Temperature at night, 101.4° F. Case removed next day for hæmorrhage; wound looks well. Temperature, second evening, 103.4° , and on the following day I operated on him, making incisions in the foot on dorsal and plantar aspects, thus converting this simple into a compound fracture and evacuating the hæma-

toma. Mixed with this blood were numerous gas-bubbles, and there was the same condition on the outer side of the leg about the fibula. In the latter place an incision five inches long was made. A considerable portion of the tibia, found to be denuded of periosteum, was cut off and the sharp edges of bone rounded. Believing the infection to be with the *bacillus aërogenes capsulatus* of Welch, which is strictly anaërobic, the wounds were irrigated with peroxide of hydrogen, and dressed with iodoform and sterile gauze, which was kept wet with peroxide of hydrogen. The infection spread no further, and was practically over when, on the eleventh day, delirium and insomnia developed. The origin of this delirium, which was at times muttering and at times violent, was unknown. A member of the society saw the case with me in consultation, and, if I remember accurately, was inclined to call it traumatic delirium. There was no renal or other discoverable organic disease. No history of alcoholism could be gained from the patient's family, employer, friends, nor subsequently from himself, when he also denied having had any syphilitic infection.

This state lasted three weeks, while the wound slowly progressed. Union was not solid until nearly eleven months had elapsed. The last time I saw the patient he had ridden five miles on his wheel to my office, and was attending to his ordinary work.

To sum up the cases. Of ten treated without ether, irrigation, drainage, or suture, there was no infection in eight. Of six where bone or muscle was sutured, in three there was no infection; one dying of nephritis. Of nine of suture of the wound, there was no infection in five, and in the final set of sixteen not sutured, there was no infection in nine.

Infection occurred in eight cases where incisions were made; in nine where none were made. Of the aseptic cases recovering, eleven wounds were enlarged and twelve not; eight of these were in the first set of cases.

Infection occurred seventeen times, was mild in six cases, severe or moderate with recovery in four, led to six amputations with one death, and one death without amputation.

The results are grouped in Table III.

TABLE III.—LOWER EXTREMITY.

	DIRECT.		INDIRECT.		NOT DETERM'D.		Total.
	Died.	Recov'd	Died.	Recov'd	Died.	Recov'd	
Tibia and fibula, shock	1	0	0	0	0	0	1
Primary amputation	1 ²	3	0	0	0	0	4
Aseptic course	1	5	0	2	1 ³	3	12
Infected	1 ¹	3	0	1	0	4 ¹	9
Total	4	11	0	3	1	7	26
Tibia, Aseptic course	0	4	0	1	1 ⁴	0	6
Infected	0	1	0	0	0	0	1
Total	0	5	0	1	1	0	7
Femur, shock	1	0	0	0	0	0	1
Aseptic course	0	1	0	1	0	0	2
Infected	0	1 ¹	0	1	0	0	2
Total	1	2	0	2	0	0	5
Femur, internal condyle, infected	0	1 ¹	0	0	0	0	1
Femur and sacrum, infected	1	0	0	0	0	0	1
Pelvis, shock	1	0	0	0	0	0	1
Total	2	1	0	0	0	0	3
Grand total	7	19	0	6	2	7	41

TABLE IV.—UPPER EXTREMITY—ALL RECOVERED.

	Direct.	Indirect.	Not determined.
Humerus, aseptic course	1	0	0
Infected	0	0	1
Humerus, external condyle, aseptic course	0	0	2
Humerus and ulna, aseptic course	1	0	0
Ulna, aseptic course	1	0	0
Radius, aseptic course	0	1	0
Radius and ulna, infected	0	1	1
Total	3	2	4=9

I have not computed the time necessary for union to take place in these compound fractures, and have paid no attention to resulting deformity. Delayed union is well known to be more frequent in compound than in simple fractures. Where much bone has been removed the resulting separation of the

¹ Late amputation.² Inhalation pneumonia.³ Delirium tremens.⁴ Nephritis.

fragments probably has some influence as well as the damage to the periosteum by the original injury or the infection. I have omitted any reference in most of the cases to the often multiple injuries. Their influence on the course of the compound fracture is very indirect, resulting through lowered vitality of the organism.

A word in regard to necrosis. This was noted in five cases, two infected and three that are classed as aseptic.

In four the violence had been direct, in one it was indirect. The two infected cases (in which necrosis occurred, Cases XXXII and XLI), have already been mentioned, had been of direct injury and of the severe type of infection.

The other three cases occurring in the services of my colleagues are

CASE XXVIII.—J. G., aged thirty-seven years. Left leg crushed by an iron beam. Tibia broken at middle third with separation of a bony fragment two centimetres square, and a second fracture two inches lower, V-shaped. Circular skin wound two centimetres in diameter, over anterior border of tibia. Periosteum stripped and torn in shreds between upper and lower lines of fracture. At the dressing, under ether, wound allowed to fill with blood-clot. Temperature that night, six hours after the operation, 102.6° F., and range for next four days 100° to 102° . No signs of infection and patient comfortable. Dressed on the second, eighth, and tenth days, and a case applied that remained ten days. Then the wound looked well and a new case was applied that remained undisturbed three weeks. Six weeks after the injury, bony union firm, eroded bone can be felt beneath granulations, but it is not movable. Patient returned later to the hospital and the separated fragment was removed.

CASE XXXI.—F. G. Kicked by a horse. Numerous abrasions of leg above and below a wound three-quarters of an inch in diameter, leading to serrated fracture of tibia. Under anæsthesia wound enlarged, cleansed, dressed with sterile gauze, and put in posterior splint. Temperature-range next four days 99.6° to 101.4° F., and no evidence of infection. A case applied in ten days and changed several times. At the end of six weeks the wound had healed; union and position good; temperature has

been normal for ten days. Two weeks later the wound reopened and was curetted, but nothing found. A month still later, a small piece of dead bone was removed from the bottom of the sinus, after which the wound finally healed.

CASE XVII.—H. H., aged thirty years. Fell about ten feet from a platform. Left tibia broken at junction of lower and middle thirds, lower fragment displaced outward, line of fracture transverse, fibula broken at a higher level. Two wounds of communication, half an inch apart, one directly over seat of fracture in tibia. This is the case added to the first set. The same afternoon the temperature was 104° F. The following day, the wound looking well, a case was applied, and remained undisturbed two weeks, when the wound was clean and granulating. Six days later the temperature rose to 106°, and the blood examination showed double tertian malarial infection. The wound did not entirely heal, though the fracture united promptly. Patient returned to have sequestrum removed six months later, when a small sequestrum surrounded by dense involucrum was removed.

In conclusion I would express the opinion that the treatment most likely to give the best results is the one in which operative interference is the smallest possible. Free incisions, immediate excision of tissues badly damaged, whether by violence or by soiling, drainage of pockets without packing of the wound, the removal of as little as possible of fragmented bone, the suture of bone or muscle in clean wounds only and with the amplest drainage, may in appropriate cases supplement the most thorough and painstaking mechanical cleansing of the wound. I have not seen medicated solutions or dressings at this time followed by any better results than the use of sterile gauze. For irrigating I believe a physiological salt solution to be as efficient as any other, and less liable to do further harm to bruised and partly devitalized tissue. What bacteria remain in the wound after thorough mechanical cleansing cannot be reached by antiseptic solutions or dressings, for they are probably embedded in tissues and inaccessible to germicides, without damaging viable tissue. The limb should be put in proper apparatus; that one being the best to use in the particular case, with which the operator is most familiar in simple fractures.

During the next few hours and days careful watch for the occurrence of symptoms of inflammation should be kept up, and at their advent there should be no delay in inspecting the wound and taking what further measures the individual case may require. Where free incisions are made, at the primary dressing, the circulation of the wound is less embarrassed by the swelling so apt to occur as a result of traumatism, and the tissues are better able to protect themselves from the harmful influences of bacterial multiplication, as they are better nourished. Absorption of toxic products is also less likely to occur, and give rise to severe constitutional symptoms.

So many cases coming to the J. Hood Wright Memorial Hospital are infected with malarial organisms that the temperature alone has not been found to be a reliable guide to the occurrence of infection in the wound. I should rather lay stress on an abnormal amount of local pain and rather free serous discharge from the wound as the earliest reliable symptoms of infection in these cases. The temperature in aseptic cases is often one or two degrees above normal during the first twenty-four or forty-eight hours, and a similar rise of less extent is quite common even in simple fractures.

Finally, I think it is to be noted with regret that our present system of hospital organization, in this city, is such that so small a number of these very serious cases of compound fracture have the benefit of the services of the visiting surgeon at the first dressing. This dressing often controls and determines the preservation or loss of both the life and limb of the patient. Much less important cases can and do wait the convenience of the surgeon, but as these require immediate attendance and occur at irregular hours through the day and night, other duties necessarily prevent his regular attendance at them to direct or assist the house-surgeon and resident staff.

SARCOMA OF KIDNEY IN AN INFANT; RECOVERY AFTER NEPHRECTOMY.

BY ROBERT ABBE, M.D.,

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MILDRED J., born March, 1898; of exceptionally healthy parents; free from hereditary tendency to tumors. Two perfectly healthy children were born before this child.

At birth the patient was observed to have a tumor in the right side of the abdomen, which continued to increase with its growth. The chance of her survival was so slight that it was decided to attempt the operation of its removal at one month of age.

Every preparation was made for operation by Dr. Halsted, of Baltimore, but a slight gain in the child's weight, observed at the time, decided a postponement.

At three months of age it was seen by me in consultation with Dr. Holt. The tumor growth had been parallel with the child's, but it did not seem to me the child had vitality to endure the necessary surgery. I advised delay until autumn. The closest scrutiny of the child's health and nutrition was maintained during the summer by Drs. Holt, of New York, and Rotch, of Boston, so that by November the child had increased in weight five pounds, and was then eight months old.

The child presented a wrinkled and old appearance, and the tumor filled three-quarters of the distended abdomen. (See Figs. 1 and 2.)

It sprang from the left loin, and crowded the colon far to the right of the median line.

The condition of the patient seemed now to justify operation, and on November 19, 1898, I operated with the following careful preparations, which, I think, conduced largely to success in so frail a subject: (1) A specially warm room for operation. (2) A

heavy ironing board thickly padded with blanket and sheet, and kept hot until the child was secured to it by bandages, so that it could be raised to a Trendelenburg position. (3) All the extremities well enveloped in cotton and flannel, and the remaining parts of the uncovered chest and abdomen constantly warmed, during the operation, by relays of steaming towels.

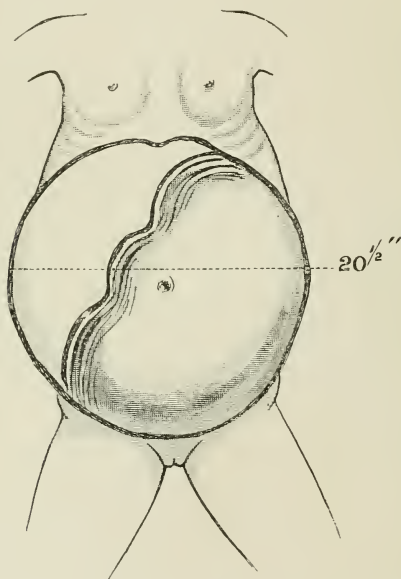


FIG. 2.—Diagram showing portion of abdomen occupied by growth, when infant was seven months old.

Care in sacrificing as little blood as possible, resulted in the loss of not more than an ounce during the operation.

Present, Drs. Emmet Holt, Frank Hartley, and W. S. Schley; assisted by Dr. Fisk.

A median incision above the navel to introduce two fingers showed the peritoneum pushed to the right of this line. A cross cut of the left half of the abdomen, from the navel to the lumbar



FIG. 1.—External appearance of infant before operation.

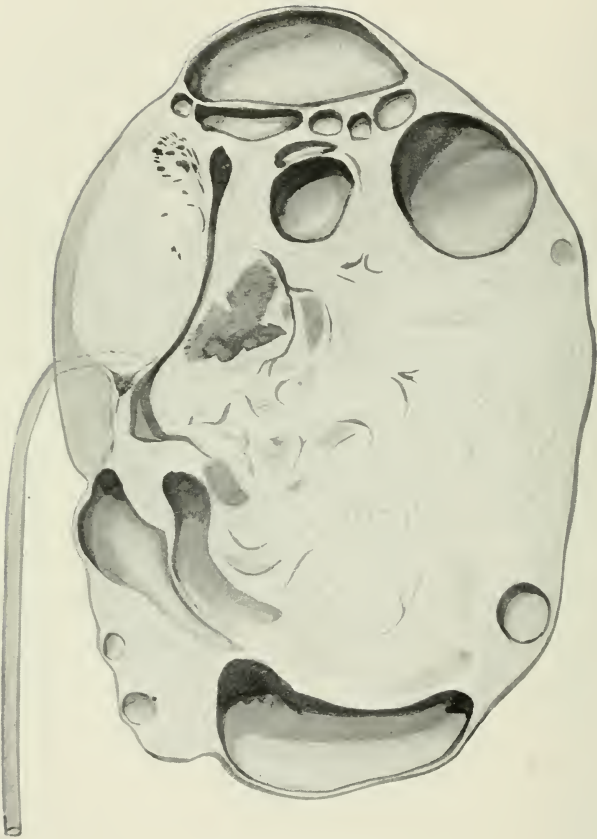


FIG. 3.—Section of tumor.

muscles, gave free access to the growth, which could be separated from the abdominal wall by blunt dissection.

The colon was spread out upon the median and upper aspect of the growth. Much care in its separation had to be exercised, to preserve its nutrient vessels.

The vascular pedicle of the large growth was at last isolated, separated from the ureter, and tied with catgut.

The ureter was cut off close to the bladder.

The abdominal wound was closed in tiers; buried silkworm-gut interrupted sutures being applied at points essential for strength, and continuous catgut sutures for other layers.

The post-operative course was one of uninterrupted convalescence.

The remaining kidney gradually increased its function, until, in ten days, it was secreting much more than the normal for both.

The child quickly gained color and flesh (six and a half pounds in three months), became as fine in health and activity as its sisters.

The removal of the tumor seemed to be clean and complete, the enucleation from its cellular bed being perfectly satisfactory. No glands or extension of disease were encountered.

The opposite kidney was normal on palpation.

Gross Appearance of the Tumor.—An irregularly lobulated mass, weighing four pounds (the child weighed fifteen pounds before operation).

On the surface of the growth were two large portions of kidney, flattened out and separated by tumor tissue.

On section they were found distended by white tumor tissue, which had so grown as to break up the gland.

Throughout the tumor were many small and large cysts filled with thin, straw-colored, albuminous fluid. (Fig. 3.)

The color of the mass on fresh section was largely pure white, interspersed with gray, flesh-colored, or mottled masses.

Microscopic examination was made by Drs. Francis S. Wood and Professor Prudden, whose report is as follows:

The tumor apparently involves the entire kidney and is enclosed in the kidney capsule, as portions of the cortical substance can still be recognized in the periphery of the growth. After hardening, it measures 18 x 14 x 9 centimetres. The surface is rather rough from the separation of adhesions and quite vascular.

The central portions of the growth are a combination of pale, soft, fibrous material, interspersed with larger and smaller areas of very soft, vascular substance, which has in places gone on to the formation of degeneration-cysts filled with blood and *débris*. The pelvis is entirely filled with large masses of the new growth. The ureter springs from the central part of the tumor and is considerably thinned and dilated.

Microscopical Examination.—Traces of renal parenchyma are still to be found near the periphery of the growth, but much altered by pressure. The remainder of the tumor is a pure spindle-celled sarcoma. No traces of muscle fibre or other congenital remnants can be found. The darker portions of the growth are the very vascular areas. The cysts are lined with a layer of endothelial cells, many of which contain blood-pigment. Some of the larger cysts have no strict lining membrane, being bordered by the spindle-cells of the tumor. The exact histological origin of the tumor-cells is somewhat difficult to determine. The fact that the capsule still remains free would exclude that site as the place of origin. On the other hand, the pelvis is still visible in places and the main growth seems to lie between the two. In earlier specimens, from other cases, when the limits of the growth could be determined with great accuracy, spindle-celled sarcomata have been observed arising from the intertubular connective tissue, and such seems to be the probability in this case.

SPLENECTOMY FOR FLOATING SPLEEN, WITH TWISTED PEDICLE.

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SURGEON TO COLUMBIA HOSPITAL.

Miss P. W., aged thirty-five years, was an inmate of Columbia Hospital first in 1893. She then had unilateral salpingo-oöphoritis. At that time a pelvic tumor was diagnosed prior to operation, which proved to be a floating spleen, not greatly, if at all, enlarged. The operation was undertaken for the relief of menorrhagia and dysmenorrhœa, and the spleen was mistaken for a subperitoneal fibroid. As the displaced spleen had not caused constitutional or, indeed, any symptoms, it was thought best not to subject the patient to an additional operation of considerable danger, and accordingly the spleen was allowed to remain. So far as the patient's symptoms were concerned, she had complete relief from her former symptoms, and remained well until the present year.

Recently she was seen by Dr. Ralph Walsh, of this city, who found her suffering from acute pain, extending over the left side and lower half of the abdomen. The abdomen was exquisitely tender to the touch, and it was not difficult to find a tumor whose most prominent portion presented to the left side and rather below the umbilicus. Owing to the very great sensitiveness and nervousness of the patient it was difficult to make a careful study of the situation and relations of the tumor to other organs. The patient presented the symptoms usually seen in patients having an ovarian cyst with twisted pedicle. Her pulse was quick, and her temperature had an evening rise to 102° F. Her physician and his consultant, knowing the former history of the case, had no difficulty in deciding the tumor to be the spleen, and the sudden onset of pain and fever due to a possible inflammation of the organ. The patient was transferred from her home to Columbia Hospital, where, after a careful study of the case, splenectomy

was performed on May 20. The operation is naturally one of great interest, and always attended by certain dangers which every operator has in mind during its performance. One of these is shock during removal of the organ from the abdomen, another is the danger of hæmorrhage after the abdomen is closed and the patient has been put to bed. We find, by reference to Greig Smith, that splenectomies for leucocythæmia are nearly always fatal. Douglas (*Journal of the American Medical Association*, April 25, 1896) says thirty-one out of thirty-six cases died, while for simple hypertrophy fifty-nine operations gave a mortality of twenty-five. Neoplasms, five operations and three deaths. Hydatids, six operations, two deaths. Wounds, forty-three operations, with eleven deaths. Asch (*International Journal of the Medical Sciences*, November, 1888) says, of ninety splenectomies, fifty-one were successful, fourteen of them were cases of wandering spleen. Ashhurst has collected twenty-one operations for injury or prolapse, all of which were successful. Fussell (G. Smith) has found sixteen operations for floating spleen with one death. The operation now reported would, therefore, come under the class most promising of success, although it will be seen that the danger to the patient is greater after than before the accident occurred which necessitated operation.

Operation.—The abdomen was opened in the median line over the middle third of the abdomen. A dark tumor at once presented, which was enveloped by the omentum and intestines for the most part, although there were some adhesions to the abdominal parietes. After removing the omentum it was not difficult to remove the spleen, which was greatly enlarged, quite soft, and of very dark color in part, due to extravasation of blood, and was adherent throughout its entire surface. The small portion of the pedicle remaining attached to the specimen shows the effect of torsion. The mesentery in this case was very long and the spleen was rotated six times on its axis. The twisting of the pedicle served to somewhat shorten its length, and hence the spleen was elevated from the pelvis, its former abode, to the position already described. Another interesting feature is the condition of the mesentery. One can see by the size of the veins, in the portion removed, how very large they are, due to extreme distention (stasis), being filled with blood-clot. This blood-clot was so extensive as to give me much anxiety lest it prove a hinderance to

recovery. The greatly distended vessels could be felt as far as the hand could reach under the stomach and along the course of the vessels supplying the stomach, pancreas, and spleen. However, no unusual symptoms appeared to prevent the patient's recovery, which is now apparently beyond question, five weeks since operation. The specimen weighed two pounds, eleven ounces, after some days' immersion in a preservative fluid.

A word about the rotation of this spleen and its fixation by adhesions. It is highly probable that the rotation of the spleen, its increased size, due in part to hæmorrhage within its substance, and the resulting severance of its vascular supply, might have ultimately resulted in complete separation from its pedicle and former connections, and its appropriation by the peritoneum, to permanently encyst, or possibly dispose of it by absorption. In fact, such cases are already recorded. This migration of an organ, or part of one, undergoing some degenerative change has been made the subject of an essay presented by the reporter to the American Gynæcological Society last year (*vide Transactions*, 1898). The adhesions are but the first step in nature's provision for either absorption or new blood-supply. It is highly probable that all foreign bodies, such as a fœtus, which has escaped from an extrauterine gestation sac, must become adherent before being disposed of by the peritoneum. In about all the cases of delayed operation for ruptured tubal pregnancy we find this condition. In conclusion, it is interesting to observe how many similar cases are to be found in medical literature. Besides Dr. Douglas's very excellent paper, already mentioned, we find others equally full of instructive and interesting observations. Dr. W. J. Conklin reports a case similar to my own in many respects (*vide Transactions of the Ohio Medical Society*, 1894, p. 366), also J. B. Sutton (*British Medical Journal*, 1892, p. 1334), also Terrier, *Bulletin et Mémoires de la Société de Chirurgie*, xx, p. 348).

The latter cites several cases of axial rotation of the spleen, and has produced a most admirable *résumé* of the subject.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 22, 1899.

The President, ANDREW J. MCCOSH, M.D., in the Chair.

OSTEOPLASTIC RESECTION OF THE SKULL.

DR. GEORGE E. BREWER presented a patient who had had Jacksonian epilepsy for several years; the convulsion beginning invariably in the right hand and arm, extending to the right leg, and finally becoming general. He was unable to give any idea of the duration of the disease, but it is probable that it had existed for at least three or four years.

During the past four or five months he had noticed a progressive weakness of the right arm and leg, and when admitted to the hospital, he walked with great difficulty, and the paralysis of the arm rendered it entirely useless.

Under chloroform anæsthesia an omega-shaped bone and scalp flap was raised over the left motor area, and the dura exposed.

A large area of chronic internal pachymeningitis was found—accompanied by a large amount of inflammatory exudate—between the dura and pia. This mass was highly vascular and caused considerable pressure on the cortex. When the dura was opened, the brain, above the area of meningeal exudate, bulged so markedly, and was so blue in color, as to suggest the presence of a cyst or tumor below the surface. A probe-director was passed for two or three inches into the brain, in several directions, with negative result. An attempt was then made to separate the dura from the pia, but before much had been accomplished a severe hæmorrhage occurred from one of the pial arteries, which was extremely difficult to control, and which was finally stopped only by passing several ligatures through the cortex, ligating the vessel deeply.

As the patient's condition at this time did not warrant further attempts to remove the mass, the dura was united with catgut, the wound closed, and sutured.

No reaction followed the operation. The patient seemed somewhat brighter from the first; the wound healed primarily. He was up and about in ten or twelve days. Although nothing was done to remove the lesion, since the operation there has been a marked improvement in the paralysis of the arm and leg, which may be explained by the possibility of, perhaps, less pressure over the thickened area, owing to a failure to completely replace the bone. This theory is favored also by the evident presence of a hard ridge in the line of incision.

TREPHINING FOR APHASIA FOLLOWING INJURY TO THE SKULL.

DR. A. J. McCOSH presented a boy, nine years old, with a good family and personal history, who, on January 8 last, was pushed down a flight of stairs, and is supposed to have struck his head against a curb-stone, although the exact history of his accident is uncertain. He did not appear to be seriously injured, and was able to go to school the following morning, but upon his return home, at noon, he acted queerly,—“silly,” his mother said. He would pick and strike at various articles and seemed to have much difficulty in speaking. It was hard to understand what he said. This difficulty in speaking gradually increased until the aphasia became complete, and he had daily attacks of vomiting. On January 14 he had a generalized convulsion and several wild spells, being apparently unconscious of what he did. When he was admitted to the hospital, on the following day (January 15), he appeared to be in a dazed condition, and there was absolute aphasia as well as agraphia. There was more or less twitching of the right hand and forearm. The boy's temperature, on admission, was 100° F.; pulse, 100. On the 17th he had two convulsions; one general, the other limited to the right side. That night he had two more convulsions, and another on the following morning. In two of these convulsions the movements were mainly confined to the right side. The symptoms indicated the presence of a clot in the anterior lower part of the motor area, and at the base of the third frontal convolution. The boy was mentally bright; he understood what was said to him and took

his food without difficulty. Accordingly the skull was opened in the region indicated, and the dura was incised. Through this opening the brain bulged somewhat, evidently due to a marked increase in the intracranial pressure. There was no evidence of a clot, and a large needle was inserted in three or four different places without finding either blood or pus. A trocar and canula of fair size were also inserted in two places, with a negative result. Then a fine needle was pushed into the right lateral ventricle, and a few drops of serum were withdrawn,—no excessive amount. The dura was sutured, the bone-flap replaced, and the wound closed. Very little reaction followed the operation.

The aphasia remained absolute for about three weeks after the accident. He then, under the tuition of his nurse, began to say a few words which were taught to him as to a baby. His vocabulary gradually increased; he learned to speak and to sing simple songs, and he can now hold a conversation on any simple subject, such as he had learned to talk about among the patients in the ward. A new brain centre was evidently developing, whether on the left or the right side it was impossible to determine. In elevating the bone-flap a Gigli saw had been used, five perforations having been made through the skull with a small trephine.

He had found some difficulty in passing the saw from one trephine opening to the other, as he did not have the necessary director at hand. As a makeshift, he fashioned a director out of a piece of tin, which served his purpose fairly well.

CORTICAL BRAIN ABSCESSES FOLLOWING OPERATION.

DR. G. E. BREWER presented a patient who was admitted to the hospital in such a condition of mental torpor that no history could be obtained. He had, however, the scar of a large osteoplastic resection of the skull over the right parietal region. Four suppurating sinuses led down to the bone, three over the anterior region of the scar and one over the posterior. From the lowest anterior sinus there projected a large piece of necrosed bone.

Under chloroform anæsthesia, the large fragment of dead bone was removed and the sinus found to lead down to, but not through, the dura. Three other small fragments were removed from the other anterior sinuses, which were found to be super-

ficial. On exploring the posterior sinus, the probe passed forward and inward for a distance of about two inches, leading to a cavity apparently situated in the parietal lobe of the brain. As it was quite impossible to satisfactorily explore this through the narrow sinus, an incision was made over its centre, the bone exposed, and a large button removed by the trephine. At the bottom of the opening thus formed there appeared a layer of very much thickened dura. This was incised, and an abscess cavity found in the cortex about the size of an English walnut. At the bottom of this cavity, which was partly filled with pus, three small fragments of necrosed bone were found and removed. The opening in the skull was enlarged with rongeur forceps, the cavity thoroughly cleaned and packed with sterile gauze, the scalp partly united, and the usual dressings applied.

No reaction followed the operation; the wound was dressed on the fourth day and the packing removed, and found to be clean. The cavity was repacked, and the second dressing allowed to remain for nearly a week. The subsequent history of the case was uneventful. He was up and about the ward in three weeks.

DR. B. FARQUHAR CURTIS said that he had done the original operation in the case just shown by Dr. Brewer. The operation was done some time ago for the relief of an epilepsy, the true Jacksonian character of which was somewhat in doubt. Some inflammatory thickening of the pia mater was found over the motor area, and the diseased membrane was cut away, but the brain was left untouched. There was considerable bleeding underneath the bone-flap, followed by secondary infection, and this, together with the tendency of the scalp to separate from the bone when the bone-flap was turned up during the operation, probably caused the necrosis of which Dr. Brewer found evidence. When the patient left the hospital, the wound was still discharging slightly from sinuses in its upper and lower portions. He was treated for a time in the Out-Door Department, but his visits there were irregular, and he finally disappeared.

CORTICAL BRAIN ABSCESS FOLLOWING COM- POUND DEPRESSED FRACTURE OF THE SKULL.

DR. BREWER presented a patient who was admitted to the City Hospital in January, 1899. Six weeks before entrance he

was hit in the forehead by an iron bar, knocked down, but not rendered unconscious, and walked some distance before falling again. He was finally, however, taken to a hospital, where he remained two weeks. About nine days after his injury he was suddenly seized with an attack of severe muscular tremor, which lasted two or three minutes, but without loss of consciousness. Since that time he has had five other attacks of a similar nature, in some of which he has lost consciousness. When admitted to hospital he complained of headache and a feeling of mental confusion.

Upon examination, a depressed scar was seen about two inches above the left orbit. Under chloroform anæsthesia an omega-shaped bone- and skin-flap was raised, including the area of depression. When the bone was lifted up two sharp depressed fragments, each about an inch in length, were found penetrating the dura and extending into an abscess cavity in the frontal lobe. A small amount of pus was also found between the periosteum and bone at the point of fracture. The bone was removed, the cavity gently curetted, irrigated, and packed with sterile gauze, the skin-flap replaced, and partly united with silkworm-gut sutures. No reaction followed the operation. The patient was up and about the ward in about two weeks.

CALCULOUS PYONEPHROSIS: NEPHRECTOMY.

DR. A. B. JOHNSON presented a woman, aged forty years, who was admitted, December 10, 1898, to Roosevelt Hospital. She was the mother of six children, the youngest being three years old. Two and a half years before admission she began to suffer from a more or less constant pain in the left loin. The pain occasionally became much more severe, and during these attacks was felt also along the course of the ureter. The attacks of pain were sometimes accompanied by a chill and a febrile movement. It was also noticed that her urine was constantly loaded with a white sediment. Since the beginning of her illness the pain has been continuous with occasional exacerbations. Examination of the abdomen revealed the presence of a firm, elongated, smooth, rounded, tender tumor, occupying the region of the left kidney, extending to the median line in front, and downward to within one inch of the umbilicus, not movable. The left ureter appeared to be enlarged and tender. The patient had no fever, but her pulse

was 104 and very feeble. Examination of the urine: Acid; specific gravity, 1028; very cloudy, heavy sediment, a large amount of albumen, and, microscopically, much pus.

The patient remained under observation until December 22, taking various tonics meanwhile. She suffered from several attacks of renal colic, during which the tumor in the loin appeared to increase in size. With the subsidence of the attacks the amount of pus in the urine appeared to be greater and the size of the tumor diminished. The patient had no frequency of urination, nor were there any other symptoms distinctly referable to the bladder. On December 22, 1898, the patient was placed in a lithotomy position, the bladder was thoroughly washed with sterile salt and water, a drachm of a 4-per-cent. solution of cocaine was introduced into the bladder and urethra, and after an interval of eight minutes Harris's double catheter was passed and put in position, and in twenty minutes two drachms of tolerably clear urine had been collected from the right catheter, and a drachm and a half of thick pus from the left. Examination of the pus obtained from the left side failed to show the presence of tubercle bacilli under the microscope; various cocci, however, were present. Two guinea-pigs were inoculated with this pus, but failed to develop tuberculosis. The urine from the right catheter was very slightly clouded, contained a small amount of albumen, and a moderate number of pus and epithelial cells. No tubercle bacilli could be found under the microscope. The examination was only slightly painful to the patient.

The patient remained in practically the same condition until January 16, 1899, when the left kidney and a portion of the ureter were removed. The fatty capsule of the organ was found hard, dense, and greatly thickened. After two-thirds of its surface had been freed, it seemed best to split the fatty capsule and enucleate the kidney first. The kidney having been thoroughly freed, the capsule was further dissected free from the surrounding structures and the pedicle exposed. The renal artery was clamped, the renal vein was tied with a heavy catgut ligature, and both vessels divided close to the kidney. The ureter was greatly enlarged and thickened, an inch and a half in diameter where it left the kidney, and an inch or more in diameter for a considerable distance below. It was stripped with the fingers to a point a little below the common iliac trunk, clamped at this point,

cut off, and the stump cauterized. The kidney, its fatty capsule, and the portion of ureter were removed in one piece. The clamps were left upon the artery and upon the stump of the ureter; the wound was washed and closed with catgut sutures by layers, the posterior three inches being left open for gauze packing, sterile gauze packing. Silk sutures were used for the skin.

The patient suffered a moderate degree of shock and received suitable stimulation. The kidney itself measured five inches in length and three and a half inches transversely; its surface was smooth, firm, and lobulated, fluctuating in places. Section of the organ showed it to consist of a series of large abscess cavities, with dense fibrous walls, each communicating with a greatly dilated pelvis, containing several ounces of thick pus and a phosphatic calculus three-quarters of an inch in its greatest diameter. No kidney tissue proper could be recognized by the naked eye. The microscope showed the lesions of chronic suppurative pyelonephritis in an advanced stage. The walls of the ureter were greatly thickened and infiltrated with pus. The calibre was dilated to the size of a No. 30 French sound, and was in a condition of chronic suppurative inflammation. Its surface was studded here and there with polypoid growths, varying in size, in the fresh state, from that of the head of a pin to that of a dried pea.

At the end of the first twenty-four hours her urine, which continued to be passed in sufficient quantity, became markedly less purulent. Her temperature rose a degree or two on the third, fourth, and fifth days, and then became normal. The clamps were removed at the end of forty-eight hours, and at the end of eight days the sutured portion of the wound was healed. Since then her general health has continued to improve. She has gained in flesh and no longer suffers from her former symptoms. A small, clean sinus, one inch deep, still persists at the posterior angle of the wound, but is now healing rapidly. Her urine is passed in sufficient quantity, is of normal specific gravity, contains no albumen, and only a few pus-cells.

Dr. Johnson said his case afforded a practical illustration of the value of Harris's double catheter for collecting the urine from each kidney. The urine from the diseased kidney was thick and filled with pus; that from the healthy kidney, while almost clear, was slightly contaminated by the urine from the opposite side of

the bladder. He also said that Dr. Harris's instrument, while very useful and entirely satisfactory for clinical purposes, was hardly exact enough for bacteriological purposes.

DR. WILLY MEYER said he fully indorsed the statement made by Dr. Johnson, that the instrument devised by Dr. Harris for segregating the urine in the bladder was valuable from a clinical rather than a bacteriological stand-point. In cases where the urine from one kidney contains much pus, it is very difficult, with this instrument, to prevent the urine from the opposite kidney from becoming contaminated. As far as his present experience goes, he believes that the results obtained with Harris's instrument generally are approximate, not absolute. For his part, he will rather continue to select the urine from each kidney with the help of ureter-catheterization.

TOTAL LARYNGECTOMY FOR EPITHELIOMA.

DR. G. E. BREWER presented a woman from whom he had removed the larynx. Her history being as follows:

The patient had been referred to him by Dr. F. C. Ard, of Plainfield, N. J. About nine months before, she had noticed a gradually increasing hoarseness, with a spasmodic, irritating cough. Upon examination Dr. Ard found a small growth just above the anterior commissure of the vocal cords. After a certain amount of preliminary treatment this was completely removed by him by means of the McKenzie forceps.

As a result of the operation, she seemed completely relieved, and remained well for two or three months. Later the symptoms returned and increased rapidly. An examination of the original growth was now made by three well-known pathologists, all of whom agreed in the diagnosis of epithelioma.

When first seen by Dr. Brewer, in November, 1898, the growth presented the appearance of a typical papilloma. It was about the size of a small pea, was situated in the anterior angle formed by the vocal cords, and was not associated with any thickening or evidence of infiltration of the surrounding tissues. She was admitted to the hospital early in December, and after a preliminary tracheotomy, an incision was made into the larynx, extending from the hyoid bone to the first ring of the trachea. The growth, with the vocal cords and the anterior third of each thyroid cartilage, was removed. The wounds were packed and the

patient made a satisfactory recovery, leaving the hospital in fourteen days. She remained well for about two months, when the growth again appeared, and this time increased with great rapidity. In about six weeks from its first appearance it had nearly filled the cavity of the larynx, and had rendered breathing difficult. She was then admitted to the Muhlenburg Hospital of Plainfield, where Dr. Brewer again operated.

Under chloroform anæsthesia an incision was made in the median line from the body of the hyoid bone to the suprasternal notch. The trachea was opened below the isthmus of the thyroid, the upper segment of the tube plugged with sponge, and the canula introduced.

From the upper extremity of the incision two additional incisions were made, extending obliquely upward towards the angles of the jaw. The two superior thyroid arteries were found and ligated, and although no enlarged glands were found, the areolar tissue surrounding the vessel was removed.

The larynx and upper part of the trachea were then cleaned and separated from their muscular attachments; the trachea divided, and the posterior surface of the cricoid carefully dissected from the œsophagus. The pharynx was not opened until the larynx had been entirely freed from its attachments to all surrounding structures. The two were then separated, the resulting pharyngeal wound completely united with catgut, the trachea sutured to the skin, and the incision partly closed and packed.

During the next ten days gauze pads, soaked in hot boric acid solution, were kept constantly over the opening of the tracheal tube. The wound was frequently dressed, and healed promptly. The patient swallowed water on the second day, and took milk and other liquid food freely after the third day. On the tenth day, as a result of a violent attack of coughing, a small leak occurred in the pharyngeal wound. This healed spontaneously, however, and gave the patient no inconvenience. She sat up on the fifteenth day, and has since been well.

THE TREATMENT OF INJURIES OF THE SPINAL CORD.

DR. PERCIVAL R. BOLTON read a paper with the above title, for which see page 171.

DR. A. B. JOHNSON said he did not entirely agree with the

statement made by Dr. Bolton regarding the futility of operative interference in certain cases of injury to the spine. At the previous meeting of the society he had shown a patient who had sustained a backward dislocation of the first lumbar vertebra. There was temporary hemiplegia, some anæsthesia, and loss of control of the bladder and rectum. This was absolute at the time of the operation, which was done about three months after the injury. Subsequent to the operation the patient regained rapid control over the functions of the bladder and rectum. The only discoverable cause for the paralysis in this case was a mass of tissue, of new formation, about one-quarter of an inch in thickness, which was firmly attached to the dura between the first and second lumbar vertebræ. The cord itself did not appear to be affected after the removal of this mass.

DR. L. A. STIMSON said the question of surgical interference or non-interference in cases of injury to the spinal column was rather complicated by the fact that very sudden and complete recovery, without direct operative interference, sometimes occurred after such injuries, even when paralysis had been extensive, and we are at a loss fully to understand—at least, from an anatomical point of view—the method in which such recovery takes place.

It is probable that after a crushing injury of the cord recovery is impossible, and any operation for its relief is futile, even if the pressure which has given rise to such injury be removed. But in cases of traumatic hæmatomyelia, however, recovery apparently may occur after a shorter or longer interval, even a year or more. This being so, the important thing is to discriminate between crushing of the cord, which is hopeless, and hæmatomyelia, which may be recovered from. The question is one of prognosis, however, not of treatment. Recent observations indicate that a differential diagnosis may be possible. Thus, in hæmatomyelia we have a disturbance of the special senses in the limbs; the heat and pain senses are maintained, while the tactile sense is lost; whereas, after complete crushing of the cords, all three of these special senses are lost. If a patient is unable to say whether he is being touched or not, but able to differentiate between heat and cold and recognize the prick of a pin, there are some grounds to anticipate that recovery will take place. The cases on record in which these phenomena have been carefully studied are still

too few in number to permit positive deductions to be drawn, but they encourage further observation and study.

The general opinion at present is that but very few cases of fracture-dislocation of the spine can be benefited by surgical interference.

DR. GEORGE WOOLSEY said that, during the past three or four years, he had seen, in hospital practice, several cases of injury to the cord which were pronounced, by neurologists, cases of hæmatomyelia. In these cases the onset of the symptoms was more gradual than in those where a crushing injury has occurred. The anæsthesia and the paralytic symptoms were not completely developed when the patients were first seen, which was, perhaps, due to the fact that the clot had not fully formed. These cases were not operated on, and in all of them an improvement became manifest after shorter or longer periods; but in every instance this improvement was only partial, and finally became stationary. In some of the cases, after a certain amount of improvement, the symptoms again became more marked, perhaps due to contraction of the cicatricial tissue. An operation would of course prove of no value when the hæmorrhage is within the cord.

DR. WILLY MEYER said that several years ago he performed laminectomy on a man who had met with an accident, fracturing his lumbar spine, producing complete paralysis of the lower extremities, but not of the bladder and rectum. Patient got worse after the operation. About half a year later, upon exposing the spinal canal and incising the dura, a number of small cavities, filled with a serous liquid, were found within the cord,—a condition similar to that of syringomyelia. The speaker said he accounted for the presence of these serous collections on the theory that the cavities had originally contained blood, of which, after absorption, only the serum remained. A similar condition is sometimes seen in the brain.

Dr. Meyer said that, in the case referred to, the patient had not improved after the operations.

DR. STIMSON said that in studying the results of injuries in this region we must consider two distinct parts of the spinal cord,—*i.e.*, the cellular portion and the fibrous portion,—the nerve-fibres. The latter may regain their power after injury, possibly even after complete division. A partial recovery following an injury of this kind may be fairly attributed to a restoration of the

conductivity of nerve-fibres which have been crushed, but not divided. When the injury is confined to the lower part of the cord, where that structure is composed almost wholly of nerve-fibres, a restoration of function is to be expected in a much larger proportion of cases than where the injury occurs higher up, where the cord is largely composed of cellular elements.

DR. CURTIS said he thought Dr. Bolton would have to qualify his statement in regard to those cases of spinal-cord injury where there is extradural pressure. The speaker said that in November, 1898, he operated on a man who had fallen five stories, striking on his back across a wooden fence, causing a fracture of the fourth and fifth dorsal vertebræ, and of the right lower extremity. He was operated on eight days after the accident, an incision being made over the fifth dorsal vertebra. Although this vertebra was normal in appearance, its spine and laminæ were found fractured and removed, and a very firm extradural blood-clot was found pressing on the cord. Upon removal of this clot it was found that it had produced a distinct impression on the surface of the cord, which could be felt under the finger. The dura was otherwise uninjured, nor was there any crushing or injury of the bone. The wound was closed without incising the dura. Subsequent to the operation the man's temperature rapidly rose to 107° F., his pulse became rapid and feeble, and death occurred, probably from shock. The autopsy was carelessly made, and the cord was badly injured in opening the spinal canal, so that its examination was unsatisfactory.

DR. ROBERT ABBE said it was very important, before operating in these cases, to ascertain, if possible, whether the symptoms are due to pressure on the cord or to actual injury of the cord itself. In some instances, the speaker thought, it was impossible to differentiate between these two conditions. Even in cases where the paralysis is instantaneous and absolute the symptoms may in time disappear without operative interference. In a certain number of cases, Dr. Abbe said, an operation was justifiable, but nothing can be gained by it in those grave cases where there is a fracture, with displacement, and crushing of the cord: even if the displaced fragment of bone is removed, the cord is usually so much injured that it cannot regain its functions.

Dr. Abbe said he had operated on perhaps eighteen of these cases, and, with a single exception, he had never seen any benefit

result from the operation, the cord inevitably having been found to be destroyed, and, after a year or two have gone by, nothing remains of it but a simple remnant of fibrous tissue, light in color, with an entire absence of white elements, and surrounded by much adhesive, plastic lymph.

As bearing on the subject of Dr. Bolton's paper, Dr. Abbe reported the following case of spinal-cord injury which had come under his observation during the past summer. The patient was a man who received a bullet-wound over the sacrum, the bullet entering at about the level of the second sacral foramen. The man was instantly paralyzed from the hips down, the paraplegia being symmetrical and complete. Six weeks after the injury, when Dr. Abbe first saw him, the patient's condition had undergone no change. An X-ray picture was taken in order to locate the bullet, which had not been removed: it was found lying about where the inner aspect of the right kidney should be, and as its point of entrance had been the left side of the sacrum, it must have traversed the spinal vertebræ at some point in order to have reached its present location. The patient was examined by Dr. Pearce Bailey, who located the spinal lesion in the last dorsal vertebra. Dr. Abbe thereupon made an incision in this region, and found the laminæ of the eleventh dorsal vertebra crushed and dusky in appearance, showing evidence of recent fracture. The fragments of bone were removed, and upon freely exposing the cord it was found to be uninjured. The bullet was found lying opposite the right kidney.

Up to the time of operation the patient's paraplegia had been absolute, but within a few days afterwards his motor and sensory functions began to return. All the muscles of the lower limbs began to regain their power with the exception of the region about the left ankle, where the muscles are still powerless and the anæsthesia persists. The patient was lost sight of about two months ago.

DR. BOLTON, in closing, said that in the cases cited by Drs. Johnson and Abbe he saw no absolute reason for excluding injury of the cauda equina, which would give rise to symptoms similar to those of hæmatomyelia. The speaker said he had seen such cases.

In regard to the case reported by Dr. Curtis, Dr. Bolton said he saw no reason to conclude that the symptoms were due to pressure on the cord by an extradural clot. It was more probable

that the cord was crushed by the depressed fragment of bone. The mere fact that a blood-clot was found there was not proof positive that the lesion of the cord was due to the clot.

DR. CURTIS, in reply to Dr. Bolton, said that in the case referred to, the limits of the dépression in the cord corresponded with those of the clot. It was not limited to the crushed lamina.

Stated Meeting, April 12, 1899.

The President, ANDREW J. McCOSH, M.D., in the Chair.

CONGENITAL INGUINO-PERINEAL HERNIA.

DR. WILLIAM B. COLEY presented a boy, seventeen years old, who had an inguino-perineal hernia, which had existed since the third week of life, the hernia having followed the testis in its descent into the perineum. The boy was operated on by Dr. Coley on March 8 of the present year, the ordinary Bassini operation being done. The sac was found to communicate with the tunica vaginalis; the latter was dissected out from the perineum, leaving enough of it to cover the testis, which was then transplanted into the scrotum, into a pocket which was first prepared for it by the introduction of the index-finger, and produced dilatation. The testis was found to be slightly atrophied. The hernial wound was closed by the usual Bassini method.

Dr. Coley said this was the fourth case of this kind upon which he had been called to operate. The first case he presented at a meeting of the society four years ago; in that instance the hernia was the size of a cocoanut and the testis was down in the perineum. The testis was so atrophied that it was removed. The second case was operated on in July, 1896, the patient being a man thirty-five years old. Dr. Coley said that this case was the only instance he had seen in which the hernia was not congenital. The testis was found to be much atrophied and was allowed to remain in the perineum.

The third case was a boy of sixteen, who was operated on in August, 1896. In that instance the hernial pouch was congenital, and the testis was lying so far back in the perineum that it could

be pushed nearly to the rectum. The same course of treatment was adopted as in the present case,—that is, the tunica vaginalis and testis were transplanted into the scrotum, and the hernial canal closed by Bassini's method. An uninterrupted recovery followed, without orchitis.

RESULTS OF OPERATION FOR UNDESCENDED TESTICLE (TWO CASES).

DR. CHARLES N. DOWD presented a boy, thirteen years old, who had been operated on about a year previous for an undescended testicle, which was retained at about the level of the external abdominal ring. The usual method of operation was pursued, cutting the cremaster muscle, pulling out the cord as best he could, and inserting a fixation suture at the external abdominal ring and one in the scrotum. By this means the testis was brought just below the pubic bone. A month after the operation the testis was still in that position, but not in the bottom of the scrotum; since then it has descended to the bottom of the scrotum, and is now in its normal position.

Dr. Dowd also presented a second patient, a boy of twelve years, who had had right inguinal hernia, and both testicles retained at the level of the external abdominal rings. He had been operated upon for his hernia by another surgeon, and at the same time the right testicle had been drawn and stitched to the scrotum; it had, however, retracted again, and can now be felt, about as large as a lima bean, at its former position. As the result of this operation had been so unsatisfactory, Dr. Dowd said he had determined to pursue a different course with the left side. He accordingly incised the transversalis fascia from the internal abdominal ring downward to the pubic bone. This liberated the vas deferens and prevented its exerting any tension on the testicle, since its course was shortened by two or three inches; it no longer passed upward over the deep epigastric artery and then downward through the inguinal canal, but passed directly to its new exit behind and then over the margin of the pubic bone. The tension from the vessels and nerve of the cord was not lessened to the same extent, but by carefully dissecting away the cremaster muscle and then exercising gentle manipulation and traction, the testicle was drawn just below the pubic bone. The tunica albuginea was then stitched to the scrotum with chromicized gut, and

the incision in the transversalis fascia was sutured with the same material. After healing the testicle was still below the pubic bone. A truss was worn for about three months to prevent its slipping back. At the present time—a year after operation—the testicle is found to have enlarged with the advance of puberty, and it is in the bottom of the scrotum. The abdominal wall is firm and free from hernia.

He did not advocate this procedure in all cases, as we do not yet know what the likelihood of hernia will be when the cord passes through this new opening. An operation for the cure of inguinal hernia has been proposed by Dr. George R. Fowler, of Brooklyn, in which the cord passes through an opening similar to this, although in that operation the peritoneum is incised and sutured with the transversalis fascia after the cord has been carried into the peritoneal cavity. When more of these operations have been reported, we may be able to estimate the strength of abdominal walls repaired in this way.

For the present Dr. Dowd advocated operations for undescended testicle by the method used in the first case, when the testicle could be brought into the scrotum without undue tension, and for other cases the transplanting of the cord according to the method used in his second case.

DR. JOHN B. WALKER said that some surgeons were disinclined to operate in these cases, claiming that the testis is undeveloped and of little or no use. The speaker said he was not in accord with that view. He believed that if the organ be dissected out and brought down before the age of puberty, it will generally prove serviceable, while, on the contrary, if it is left in its abnormal position until adult life, it will be of no use. In the latter class of cases the spermatozoa have not been found.

Dr. Walker said that personally he had operated on three of these cases. In all of them, after the adhesions of the cord were separated, the testis could be brought down without much difficulty. It now becomes most important to retain the testis at the bottom of the scrotum. It can be best accomplished by passing a suture through the most dependent portion of the tunica vaginalis close to the base of the testis, and then out through the scrotum, and then either passing over one of the bars of a small wire cage made to fit over the scrotum or suturing it directly to

the skin of the thigh. This suture, if properly placed, produces not enough tension to cause any sloughing.

DR. ROBERT ABBE said that in his own cases there had always been subsequent retraction of the testis, which was probably due to the fact that he did not secure the organ at the external inguinal ring by stitching. This he thought should be done; otherwise the remnant of the cremaster muscle will draw the testis back again.

DR. B. FARQUHAR CURTIS said that in a case of this kind, where he had recently operated, he passed a stitch through the testis, scrotum, and then through the skin of the thigh, on its inner side below the perineum, in order to secure the testis well down below the ring. The latter should always be closed, as in Macewen's operation for hernia. The functional result of these operations is usually doubtful.

DR. COLEY said he had operated on twelve cases of undescended testis, all of them associated with hernia. In the cases operated on from 1892 to 1895 he tried anchoring the testis in the scrotum, and invariably retraction of the organ took place. The time of operating on these patients should preferably be delayed until the beginning of puberty, for the reason that in many cases the testis comes down itself just before puberty. The Fowler operation, to which Dr. Dowd referred, gives a considerable increase in the length of the cord, and is the only satisfactory method of bringing the testis well down into the scrotum.

DR. ROBERT H. M. DAWBARN said he was not inclined to agree with the previous speaker regarding the wisdom of waiting until puberty before undertaking an operation in these cases, inasmuch as this condition of cryptorchidism is perhaps the commonest source of sarcoma of the testis. The sooner the organ is removed from its abnormal position, where it is pressed upon and irritated by the firm walls of the inguinal canal, therefore, the better. In the two cases shown by Dr. Dowd, the result was certainly very satisfactory. In some cases, however, the cord is so short that one can barely get the testis outside the external abdominal ring. In such a case, Dr. Dawbarn said, he had already suggested and repeatedly used the idea of supplying the testis, by a blunt dissection, with a new scrotum behind the abdominal muscles, and an inch or so above the inguinal region. (Wood's "Reference Handbook," Vol. ix, p. 415, also "Transplanta-

tion of Testicles," *Record*, May 1, 1895.) The testis has its cord neatly wrapped about it, and is not at all uncomfortable. It has only the peritoneum and intestines behind it. Dr. DeGarmo, of this city, in a pamphlet recently published, advocates the same plan, which he had thought out independently of Dr. Dawbarn, though a number of years later, and had successfully resorted to it in several cases. This same idea is worth considering in effecting radical cure of hernia, as a modification of Bassini's method. The testicle can doubtless continue to functionate in its new and comfortable bed; and we have no inguinal canal left, and no abdominal rings, to invite a return of the rupture; but, instead, have a perfectly solid belly-wall.

RESECTION OF THE ELBOW.

DR. HOWARD LILIENTHAL showed a young man, nineteen years old, who, in 1896, was admitted to Mt. Sinai Hospital for a gun-stock deformity of the left arm, which had followed a fracture of the limb six years previously. On account of the deformity the arm was of little or no use.

Dr. Lilienthal operated in September, 1896. He found a dislocation of the ulna upward and inward, and there was bony union between the broken-off external condyle of the humerus and the upper portion of the shaft of the radius. This portion of the bones was chiselled off, and then a typical resection was done, with the exception that the head of the radius was left intact. The splint was left off after one month. Slight suppuration of the soft parts followed the operation. In spite of this, and despite the fact that the head of the radius is entirely out of its normal position, the functions of the joint are fairly good. Flexion is very good, while pronation and supination are excellent, and there is practically no lateral mobility. The ulna has shifted far towards the inner side, and the radius has also been pushed upward and backward, and presents a small exostosis.

In reply to a question by Dr. Bryant, as to how much of the bone was left in the excision, the speaker said he had done a typical resection, with the exception that the head of the radius was left behind. The external condyle, which had been broken off at the time of the fracture, was found to be united by bone to the shaft of the radius. The humerus was sawn through above the condyles; the ulna below the coronoid process. The radius

was not touched. If suppuration had not occurred, a more slightly result would probably have been obtained.

In connection with this case, Dr. Lilienthal exhibited a radiograph showing the present position of the bones.

COMPOUND DEPRESSED FRACTURE OF THE SKULL.

DR. JOHN F. ERDMANN presented a man who, in February of the present year, was struck on the head by a dumb-waiter, producing a compound depressed fracture of the left side of the skull; the dura was also torn, and fully two teaspoonfuls of brain substance escaped at the time of the accident, which was followed by hemiplegia.

In operating on the case, Dr. Erdmann said that, after elevating the bone and removing the fragments, he sutured the dura, first having inserted a piece of ordinary rubber tissue into the contused brain matter, and then closed the wound. At the end of three weeks a return of function was noticed in the lower extremity on the paralyzed side, and at the end of six weeks a fair amount of function in both upper and lower extremities had been regained. Full control of the limbs, however, had not yet been secured.

EXTRADURAL HÆMORRHAGE.

DR. B. FARQUHAR CURTIS presented a man, thirty-two years old, who, last January, while intoxicated, fell into an area, striking on his head. He was unconscious, and was carried into the house, and lay for some hours in the cold basement without medical attendance. On the following morning a physician was called, who found the man still unconscious and with a subnormal temperature. It was then decided that he was suffering from something more serious than alcoholism, and under the use of hot applications, etc., a good reaction was obtained.

When Dr. Curtis saw the patient in the afternoon of the day following the accident, his temperature had risen to 101.2° F.; he was in a comatose condition, from which he could only be roused with difficulty. He made no effort to talk, but would mumble unintelligibly. His breathing was stertorous. The left cheek was bruised, and there was decided exophthalmus on the left side. The pupils were equal and reacted to light; there was

no bleeding from the mouth, ear, or nose. There was evidently at first a right hemiplegia, but this disappeared so rapidly that it was decided to postpone operative interference. On the third day after the accident the patient was decidedly better. He rested more easily, and his paralysis, with the exception of the face, had nearly disappeared. He was somewhat aphasic, but was able to recognize his friends. Two days later his condition became a trifle worse, and an operation was decided upon. After a horse-shoe-shaped incision in the left side of the scalp, four trephine openings were made and a bone-flap of considerable size elevated. Underneath this a clot of blood was found, at least an inch and a half thick at its centre, extending well forward into the anterior fossa, an inch or so beyond the limits of the bone-flap. It also extended into the base of the skull, reaching nearly to the middle line of that region. When this clot was removed, the brain did not expand, a cup-like cavity being left. A fissure was found in the frontal bone, running downward into the orbital roof. The wound was closed, a small aperture being left for drainage.

Following the operation, the patient showed some symptoms of brain excitement and mild delirium, and his temperature remained slightly elevated for some time, although the wound was aseptic. He steadily improved, and was able to leave the hospital after one month. During the last week of his stay there his improvement was very rapid. The paralysis disappeared completely, and he has entirely recovered his faculties. The sight of the left eye has been lost as the result of the accident, due to atrophy of the optic nerve, which was probably injured either by the fracture or by subsequent hæmorrhage into the sheath. The exophthalmus, which was evidently due to the clot, disappeared slowly.

MOLLUSCUM FIBROSUM.

DR. FRED. KAMMERER presented a middle-aged woman with innumerable pea-sized tumors scattered over the skin, and, in addition to these, an enormous tumor which was attached to the anterior wall of the thorax, about the right breast, and extended downward beyond the hip. The patient stated she had first noticed this tumor over twenty-six years ago, and since then it had been steadily increasing in size. Dr. Kammerer said the case was one of molluscum fibrosum. The small tumors were distributed

over the trunk and the extremities, and lying in the upper layers of the cutis in an unsymmetrical way.

DR. CURTIS said that, while the tumor of the breast in the case shown by Dr. Kammerer was undoubtedly fibrous in character, he thought it belonged to the type known as elephantiasis of the nerves,—a neurofibroma. A man who for many years had been an inmate of Bellevue Hospital, and recently died there, had an exactly similar tumor springing from the scalp and hanging down over his face and side of his head to the shoulder.

DR. KAMMERER said the theory had been advanced that in all these cases of multiple fibrous tumors of the skin, whether soft or hard, the growths were in some way connected with the nerves. The case he had shown corresponded exactly with what Hebra has described as *molluscum fibrosum*. The speaker said he did not remember the exact pathology of these growths. He inquired whether Dr. Curtis meant to imply that they always sprang from the nerves themselves.

DR. CURTIS replied that he thought they sprang from the sheath of the nerve.

DR. KAMMERER said he failed to see the sharp line of distinction Dr. Curtis would draw between neurofibroma and *molluscum fibrosum*. He did not know that these fibromata invariably developed from the sheath of nerves. He thought it was accepted that they might also spring from the connective tissue of the outer coat of the vessels and of the subcutaneous fat. On the other hand, in cases of *molluscum fibrosum* hard nodes had been described in the deeper tissues along the course of nerves and evidently connected with them. At all events, he felt justified in classing the case as one of *molluscum fibrosum*, leaving out of consideration the question of the origin of the tumors from nerve-fibres.

THE VALUE OF THE X-RAYS IN DETECTING SMALL RENAL CALCULI.

DR. ROBERT ABBE read a paper with the above title, for which see page 178.

DR. PARKER SYMS said that all surgeons appreciated the value of radiography in the diagnosis of renal stone when the picture gave a positive result. There are cases, however, where the clinical symptoms strongly point to the presence of stone,

and in which the result of an X-ray picture is absolutely negative. The speaker asked Dr. Abbe what weight he attached to such negative results in the face of strong clinical symptoms.

DR. ABBE replied that if a good X-ray picture, displaying ribs and spine well (perhaps corroborated by a second one), failed to show the presence of a stone in the kidney, he felt well satisfied that there was no stone of any size there.

ENTEROLITH.

DR. JOHN F. ERDMANN exhibited an enterolith which he had removed from a woman, fifty-seven years old, who, when she came to him, gave a history of intestinal obstruction. Twenty years ago the woman had been operated on for an ovarian cyst. Recently she had lost fifteen or twenty pounds in weight, and was very much exhausted. Dr. Erdmann operated on September 21, 1898. On opening the abdomen he found a mass which measured twelve inches in the long circumference and three inches transversely, and weighed about four and a half ounces. It was situated directly opposite the third lumbar vertebra, and the intestines were covered by a membrane which proved to be the posterior layer of the ovarian cyst, for which the patient had been operated on years before. The patient died on the fifth day, after operation of suppression of urine. The greater part of the enterolith was composed of faecal matter.

PROGRESS OF REPAIR OF INTESTINE, TEN DAYS AFTER SUTURE.

DR. P. R. BOLTON presented specimens with the following history: B. M., male, aged twenty-six years; a native of Switzerland and a baker by occupation, was admitted to the hospital on February 4, 1899, suffering from a 38-calibre pistol-shot wound, which had been self-inflicted, with suicidal intent, just previous to his admission. The wound was in the epigastrium, about two inches to the right of the midline, on a level with the cartilage of the tenth rib. An operation was undertaken about two hours after the man was brought to the hospital. Under ether, a three-inch median incision was made, ending just below the umbilicus. This revealed the presence of a large amount of blood and free gas in the abdominal cavity. The omentum was perforated and

bleeding freely on both sides. After tying the bleeding vessels, the incision was extended downward three inches. Five perforations were found in the jejunum within a short distance of each other; the prolapsed mucous membrane was inverted, and they were sutured successively as found. The mesentery of this portion of the gut was found perforated at one point, the bleeding having apparently stopped spontaneously. A cut vessel was found and tied. There had apparently been but very little escape of faecal matter into the peritoneal cavity. The cavity was cleansed of blood, irrigated, and the wound closed without drainage. During the night following the operation there was frequent vomiting, and at 3 A.M. the temperature had risen to 104.2° F., and it remained continuously high—ranging from 103° to 105°—from this time until the patient's death, which occurred nine days later. Wound healing was normal.

About a week after operation signs of consolidation of the right lung became manifest, and two days later the patient became delirious, extremely weak, and died. The autopsy, made on the following day, showed an inhalation pneumonia of the lower lobes of both lungs, and a few patches of recent consolidation in the upper lobes. An examination of the intestines showed five perforations within the first four feet of the jejunum. The suture lines showed partial union and were impervious to water. There was no evidence of either a local or general peritonitis.

Pathological Report.—Sections taken vertically through the sutured portions of the intestine show the serous coats in close apposition, the line of suture being indicated only by a slender line of cells with elongated, spindle-shaped nuclei. The muscular layers on either side of the apposed peritoneal coats have a fairly normal appearance, except about the free, cut ends of the gut, where all the layers are surrounded and invaded by a mass of new connective tissue, containing many cells with large, pale, oval, and spindle-shaped nuclei, a comparatively small number of small round cells, a few giant-cells, and many new, thin-walled blood-vessels. The mucous membrane at the free ends has in part become destroyed, and is infiltrated with the new connective tissue just described. In the peritoneal and muscular layers can be seen small fragments of black silk thread. The thread fibres are in places somewhat separated, and between these can be seen scattered a few round cells. In other places, however, the thread

fragments show no cell accumulation about them, and lie in the tissues, without producing, apparently, the slightest irritation or inflammatory reaction.

MULTIPLE RENAL CALCULI.

DR. BRIDDON presented calculi, weighing six ounces and a half (Troy), removed by operation from the right kidney, calculi having been passed from the left at varying periods eleven years before. Death on twenty-eighth day from coma; age, thirty-eight years.

On December 3, 1891, patient was operated on in Presbyterian Hospital for strangulated hernia, from which she made a good recovery. At that time she gave a history of an attack, three years before, of renal colic, on the left side, with passage of a small calculus after the attack. While in the hospital she had a similar attack, lasting several hours, marked by severe pain, at first localized in the left lumbar region, and later radiating forward into the groin and left thigh. Patient vomited once or twice and perspired profusely, but had no chill. At the next urination, after the pain ceased, a small calculus was passed, and there was blood in the urine. She was advised to take some preparation of lithia, which she did for a number of years. She continued to have attacks of renal colic on the left side at intervals of six to twelve weeks, with passage of calculi, until three years ago. Since then she has enjoyed good health until December 21, 1898, two days before her second admission to the hospital, when she had a severe attack of colic on the right side, lasting twenty-four hours, and marked by severe, sharp pain in the right lumbar region, radiating forward and downward into the groin. Patient vomited once or twice every hour. She passed no gravel. There was no hæmaturia nor frequency of urination.

On admission, over the right kidney there was tenderness, where also could be felt a tumor, the size of a large cocoanut, which was slightly movable by a hand in front and behind; it descended with respiration. Percussion over it was dull.

January 6, 1899, a cystoscopic examination was made and ureters catheterized by Dr. F. Tilden Brown. The urine was examined by Dr. Frederic E. Soudern, who made the following report: "Specific gravity is 1008. The specimens obtained separately from each kidney show practically the same chemical and

microscopical picture. The presence of considerable albumen, and numerous hyaline and granular casts, and a relatively low excretion of urica, together with considerable pus and tubular plugs of the same, and groups of epithelial cells, presumably from the renal pelvis, would indicate a well-marked pyelonephritis of both kidneys. The bladder specimens show, in addition to the above, evidences of a marked chronic cystitis, with probably some superficial ulcerating areas. There is considerable uric acid."

A nephrotomy of the right kidney was advised, but for personal reasons the patient went home and returned on January 23 for operation, which was performed as follows:

Kidney exposed by lumbar incision on February 1. The finger, introduced at this time, detected a large number of calculi just beneath the thinned-out kidney cortex. An opening, two inches long, was then made in the posterior border of the kidney, and a large cavity opened, from which five or six ounces of turbid purulent urine escaped, and fifty or sixty various-sized calculi were removed by the fingers and scoop. When this cavity was evacuated, more calculi could be felt through thin partition walls of kidney substance. From each of these, when broken into, more purulent fluid escaped, and many calculi were removed. There seemed to be five or six such subdivisions, between which no channel of communication could be demonstrated. One of the largest of the calculi was found in the pelvis of the kidney. Everywhere the kidney tissue was very much thinned out by the enormously dilated calyces. The kidney was then thoroughly flushed out with hot salt solution, and large rubber drainage-tubes inserted, surrounded by sterile gauze drains, and an aseptic dressing applied. Patient left the operating-room in good condition.

The calculi removed numbered 149, and varied in size from a small hen's egg to a bird-shot. The total weight was six and a quarter ounces (Troy). The largest calculus was four and three-quarters by four inches in circumference, and weighed one ounce and one and two-thirds drachms. The four next in size, each weighed over three drachms. One weighed two drachms, and ten over one drachm each.

The patient made a good recovery from the anæsthetic, and during the next twenty-four hours passed twenty-eight ounces of urine, as she did also the day following, the fluid being tinged



Dr. Briddon's specimens of renal calculi.

with blood. Her bowels moved on the fourth day, and on the fifth day she was started on tartar-lithine tablets, two, four times a day. For the next two weeks the patient improved gradually but slowly, taking nourishment well, and voiding from twenty-eight to thirty-eight ounces of urine, besides a considerable amount secreted from the wound, necessitating a change of dressing several times a day.

On the twenty-first day after the operation, the patient became apathetic, complaining of weakness, nausea, disinclination to take food, and she frequently vomited.

On the twenty-fourth there was noticed occasional twitching of the muscles of the face and upper extremity. These conditions continued until the convulsions became general. In the intervals the patient could not be roused, and when they ceased the patient lapsed into a condition of profound coma.

The uræmic symptoms were treated by three hot saline infusions, in quantities of fifteen hundred centimetres each, frequent rectal irrigations with Kemp's tubes, hot-air baths, and derivation by way of the alimentary canal. The infusions certainly but only temporarily benefited, and rectal irrigations, continued for thirty minutes at a time, were usually followed by perspiration; but in spite of all these measures, the patient gradually sank, and died on the twenty-eighth day after the operation.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, May 1, 1899.

The President, J. EWING MEARS, M.D., in the Chair.

ACUTE CHOLECYSTITIS; CÆLIOTOMY.

DR. ALFRED C. WOOD remarked that acute inflammation of the gall-bladder, as a complication or sequel of the infectious diseases, has been recognized for a long time. There is, however, another class of cases to which his attention had been called but recently, in which the disease develops suddenly, in a person in good health, and in many instances in whom there has been no previous symptom referable to the biliary system. It is to this class that the case reported belongs.

Miss E. R., single, aged twenty-seven years. For a year prior to the present illness there had been some pain, at times, in the right iliac fossa, which was thought to be ovarian in origin, and to be the result of using a sewing machine a great deal.

On August 31, last, she left home in her usual health to visit friends; during the night she was awakened with a chill, which she said was a very hard one, and lasted for a considerable time. After the chill had passed she fell asleep, and woke later with a high fever and severe pain in the head and back. A physician was summoned, who administered an hypodermic injection of morphine for the severe pain in the back. During the day (September 1) nausea and vomiting supervened. The matter vomited was principally bile. Severe general abdominal pain was next noted. There was no bowel disturbance. During the following ten days the same conditions prevailed, sometimes better and other times worse. The temperature ranged between 102° and 105° F.; the pulse at times being as high as 150. The abdomen was very tender to the touch, and gradually became more and

more distended until, on the tenth day, it was said to have been extreme. During this time the treatment had consisted in the administration of morphine to relieve the pain, and calomel, when necessary, to secure an action of the bowels. The diet had been limited to liquids, and turpentine and hot fomentations were applied to relieve the abdominal pain and distention.

She was first seen by Dr. Wood on the eleventh day of her illness. At the time of his examination the patient's expression was that of a person extremely ill, being that commonly observed in cases of peritonitis. The temperature was $103\frac{3}{4}^{\circ}$ F., the pulse 130, and the respiration 34. The abdomen was uniformly distended and everywhere exquisitely tender to the touch. In fact, the jarring of the bed, caused by a person walking across the room, gave rise to acute pain. The patient lay on her back with the knees drawn up; the abdomen was everywhere tympanitic. Palpation yielded no information, save that the tenderness seemed slightly more acute at some points than at others. This sign was of no value, however, inasmuch as the points of greatest tenderness changed at successive examinations. It was never sufficiently constant at McBurney's point or over the gall-bladder to point conclusively to either of these regions as the origin of the trouble; in fact, the left iliac region, the right lumbar region, and the left hypochondriac regions were successively found to be the most sensitive points to pressure.

Being unable to decide whether the patient's condition had its origin in the appendix or in the gall-bladder, he advised an abdominal section, intending to first explore the right iliac fossa, and if this were found normal to examine the gall-bladder. The patient was, however, in a remote district of the country, where the necessary appliances for carrying out a modern operation were not obtainable, and where it would have been impossible to have given her the proper attention after operation. She was therefore removed to the University Hospital, in this city, a distance of 500 miles, where the case was further studied. During the two days that elapsed between her arrival at the hospital and the time for operation, the symptoms seemed to point more and more towards appendicitis. There seemed to be slightly more resistance in the right iliac region than elsewhere over the abdomen, and that there was a gradually developing dulness.

When the common incision for reaching the appendix was

made, the contents of the right iliac fossa were found to be absolutely normal, but on passing his hand up towards the gall-bladder a large mass was discovered which led him to prolong his incision upward to that point, where he found the viscera adherent to each other and to the anterior abdominal wall. On separating the adhesions a considerable quantity of purulent bile was evacuated. The patient's condition was such that he was then obliged to provide for drainage, to pack off the general peritoneal cavity with gauze, and to close the wound as rapidly as possible.

The convalescence was slow but uninterrupted. The temperature reached the normal point on the sixth day. Bile flowed freely from the opening for several weeks, but the sinus finally closed and remains healed at the time of this writing (June, 1899).

He reported this case thus fully because he believed, with Dr. Maurice H. Richardson, who, in his excellent article in the *American Journal of the Medical Sciences*, Vol. cxv, 1898, p. 629, states that "this subject seems worthy of discussion in connection with that of acute abdominal lesions demanding immediate interference; for acute cholecystitis,—acute accidental cholecystitis, if I may thus designate this lesion,—though comparatively rare, is more frequent than such well-recognized lesions as intussusception, volvulus, or other forms of acute intestinal obstructions."

Acute phlegmonous inflammation of the gall-bladder is eminently a surgical affection and demands early operative intervention. Although healthy bile is said to be sterile, and to be tolerated by the peritoneum, the condition is quite different when the gall-bladder is the seat of an infectious inflammation. In the class of cases to which the one just reported belongs, it would seem, in the present state of our knowledge, that the diagnosis must not infrequently be made at the time of operation. In the case described there had been no illness for nine years; there had never been a single symptom of the presence of gall-stones. He did not know whether in the beginning of the attack careful palpation would have revealed the presence of a distended gall-bladder or not, but by the eleventh day the abdominal distention was so great that it was impossible to determine this point. There are cases in which the localization of the pain and the distention of the gall-bladder will lead to an immediate recognition of the trouble, but there are others in which, as in this one, it is abso-

lutely impossible to distinguish it from appendicitis or a local peritonitis due to rupture of an intestinal or a gastric ulcer or other similar cause.

The operative treatment of acute cholecystitis should be as successful as that of appendicitis, if an early diagnosis be made. The technique need not be described, as this is familiar to every surgeon.

Dr. Richardson reports (*loc. cit.*) ten cases of acute cholecystitis without known pre-existing disease, in a total of fifty-nine operations upon the gall-bladder, a most interesting series and well worthy of careful study. In some of these the histories are very similar to the one detailed, although the temperature in the latter was rather higher than in the series referred to.

THE CHOICE OF OPERATIONS UPON THE MALE BLADDER.

DR. JOHN H. BRINTON said that when this subject was brought before the academy on a recent occasion, (*ANNALS OF SURGERY*, July, 1899, p. 103), it seemed to him that book directions were too closely adhered to; that there was a somewhat vague impression of individual opinion, and that sufficient prominence was hardly given to every-day, real practice.

The procedures or operations on the male bladder, to which he particularly referred, were, first, litholapaxy; secondly, the different methods of perineal lithotomy; and, lastly, the suprapubic or high operation of cystotomy. First, however, he recalled, for a moment, the old method of lithotrity, now practically obsolete. It had, he thought, its advantages, at all events for a time, and it had great disadvantages. In the early days the stone was usually crushed with the fenestrated instrument. This, from its then faulty construction, sometimes nipped the vesical walls; indeed, he had seen a strip of mucous membrane come away hanging from between the blades. Then, too, the fragments were simply broken, of rather large size, and often angular; although finer and better work was later done by the use of the duck-bill lithotrite.

A complication attending the use of all of these instruments was the liability of the blades to become clogged with imperfectly crushed fragments. When this occurred, the withdrawal of

the instrument was sometimes difficult; and he had known serious injury to be inflicted on the walls of the deep urethra.

He remembered operating on a case in a large hospital in this city, a great many years ago, using a crusher, which at that time was considered a very satisfactory instrument. It did its work apparently well, and yet, when he came to withdraw it, he found great difficulty in bringing it through the urethra. It had clogged, allowing a large piece of stone to become thoroughly and firmly impacted. He worked very carefully for a long time,—the patient was an old man,—and succeeded, finally, in extracting the instrument. At the same time, so much injury was done to the urethra that, from shock of the operation and injury to the walls of the urethra, death took place after several days, and on post-mortem examination, the walls of the urethra were found to be severely bruised and were on the point of sloughing.

Then, he knew of another case, in the practice of a prominent surgeon, in which the urethra was absolutely torn off, the result of a clogged lithotrite, and that patient died.

In connection with lithotrity, he recalled to memory the operation of a great surgeon, one who was in fact a surgeon to the very ends of his fingers, the late Professor Joseph Pancoast. Any one who had seen him operate would recall the wonderful facility and certainty with which he would find and catch the stone, and the skill with which he would crush it into fine pieces. He never would explain exactly how he found the stone. His directions were simply these: "You put the instrument into the bladder, turn it around, and pick up the stone." That was all; and in this respect he spoke much as Civiale did. Dr. Brinton had often closely watched Dr. Pancoast in this operation, and he was quite sure that he always followed a carefully considered plan of procedure to detect and grasp the stone. His technique, to use our modern term, was always the same: it was one from which he never deviated. Dr. Pancoast, having introduced his instrument into the partially dilated bladder, would push it right back until it reached the posterior wall of the bladder, then, turning the instrument eighty or ninety degrees, he would gently draw it forward along the left side of the vesical walls, until the hooked blade would be arrested by the posterior portion of the prostate. He then depressed the handle between the thighs of the patient, so that the elevated

curved beak could sweep closely and accurately behind the prostate, and this manœuvre he would repeat to insure an exhaustive search of the vesical neck and post-prostatic region. This done the instrument was pushed backward, along the right side, to the posterior wall of the bladder, drawn forward, and the right side searched in like manner. Then with beak upturned, the anterior wall was swept, to discover any possible encysted calculus. When any calculus was detected loose in the bladder, he would with the curve of the instrument make slight pressure, so as to form a sort of cup in the mucous membrane, and then gently separating the blades, tapping them with some small metallic object, would receive the calculus, between the open blades slightly rotated to receive it. This was his manipulation for the detection and grasping of the stone; simple enough in practice, but almost magical to the eyes of a by-stander. The rest, to use Dr. Pancoast's words, the getting rid of the stone, was best accomplished by crushing it moderately fine, and letting the patient "piddle it out." This operation of lithotrity, a good one in its time, has, however, passed away, and is now superseded by litholapaxy. The latter has its advantages,—advantages in rapidity,—in the fact that the operation is done at a single sitting, and that, when done well, it is a very thorough operation. Now as to litholapaxy. What are the difficulties of this procedure, and has it any dangers? The difficulties of too small a urethra, or contracted meatus, may usually be easily overcome. With a delicate hand and gentle touch, manipulation may possibly be carried on despite an enlarged and tender prostate. There is no great difficulty in catching a stone, and in properly breaking it. The fenestrated lithotrite has given way to safer treatments, and we have the powerful and lipped crushers of Bigelow; the varieties of Thompson's instrument, and the powerful one of Forbes, possibly the best yet devised.

The crusher which he preferred is a Thompson instrument, changed and modified. It has the exact curve of Bigelow's instrument, with a shorter female blade, and a strong, indented male blade, with teeth sloping outward. These blades are so fashioned that impaction under any circumstances is impossible, and the instrument can always be readily inserted and withdrawn. Its size is No. 27 of the French scale.

As to the dangers of litholapaxy, for dangers there are, and

patients do die often after this operation. Every surgeon of to-day, who has had much to do with crushing stone, has seen or known of death following litholapaxy. Professor Bigelow, in his early paper, in 1878, gives one death occurring in seven cases, and remarks, "It must pass for what it is worth." Immediately after the announcement of the method of litholapaxy the speaker was greatly attracted by the description given, and he determined to make trial of the operation. He did so, and in two days lost his patient, the only one he had ever lost after this procedure. This set him to thinking, and he tried experimentally to determine in what the danger lay. He took bladders, human and from the pig, placed them on the table, and injected into them varying measured amounts of water, having first inserted fragments of crushed calculi. He then made use of Bigelow's evacuating bag and tube, carefully noting the degree of digital pressure on the bag, just sufficient to agitate the fragments, the amount of water thrown in, and the distending effect upon the bladder. With a stiff rubber bulb, the amount thrown in by moderate pressure was about one and a half to two ounces; with a softer and more easily compressed rubber, from two to three ounces. The distending effects upon a bladder already nearly filled was very great, and he could understand how in a living bladder, especially if diseased, unlooked-for injury might be produced.

From experiments made upon bladders of varying capacity he was convinced that, unless the surgeon is practised and careful, he may by too rapid and over-distention unwittingly inflict damage upon a bladder to a disastrous and even fatal extent. To avoid such results he had, to his own mind, laid down the rules to be rigidly observed in the performance of the operation of litholapaxy.

- (1) Draw off all accumulated urine, and carefully determine the full painless capacity of the bladder, two or three days before operation.

- (2) In like manner determine the capacity of the bladder when patient is etherized for operation.

- (3) Before using the evacuating instrument throw into the bladder boric acid or other proper antiseptic solution, to the extent of not more than three-fourths its capacity under ether. Thus, if the bladder will easily hold eight ounces, inject not more than six ounces.

(4) Use only moderate efforts with the evacuating instrument, making short, quick, squeezing pressure-movements with the fingers.

This matter of the over-distention of the bladder he believed to be one of the greatest dangers of litholapaxy. It can, however, be avoided, if the operator will only bear in mind the natural capacity of the bladder, and at all stages of his procedure refrain from throwing into the organ more than it can bear without undue strain. He should always keep one-fourth at least of the bladder empty. Clinically he had observed that a disregard of these precautions had been followed by disastrous results; and this is only what one might expect, when it is remembered that, in this operation, one has often to proceed in the face of, possibly, associate affections of the prostate, ureters, and kidney.

There is one clinical symptom which has not attracted attention,—viz., the groaning of the patient under ether, coincident with distention of the bladder. He thought that this is produced by over-distention, most apt to occur at the beginning of the evacuation, before leakage by the urethra to any extent has occurred, or just after the bladder has been refilled. He looked upon this groaning under ether, the result of pressure from the evacuating bulb, as a prophetic symptom of the gravest nature.

From what he had said it would be inferred that he regarded the operation of litholapaxy as a dangerous one in the hands of the general surgeon, and so he did. He looked upon it as very dangerous, save at the hands of a skilled few. He was sure that he was not alone in this view.

Passing now to the suprapubic operation,—is there not much to be said in its favor? It can be done with the greatest ease, and when the bladder is opened, a thorough examination of that organ can be made. Any calculus present can be detected absolutely and at once, whether loose, or encysted, or hidden behind a projecting lip of the prostate. Not only can the finger be used in the examination, but by the employment of proper electric illumination the interior of the bladder may be thoroughly inspected. Any foreign substance can be detected and removed, and, if the operator so wishes, protruding portions of the prostate may readily be taken away. The entire cavity of the bladder is under view; any necessary operative manipulation can be rapidly and efficiently performed; and when finished, the

surgeon has that comfortable certainty of mind that he has seen everything inside the bladder; that nothing has been concealed or omitted; and that he has done for his patient all that he believed to be right. This certainly is a great matter in exact procedures, and cannot be arrived at by any other process than suprapubic cystotomy. The radical treatment of stone and its complications is thus made easy.

As for the dangers of the suprapubic operation, done in accordance with modern precautions, and with a full antiseptic technique, they are not great. The speaker had done a good many high operations for stone and for drainage, and had been so fortunate as never to lose a case. He had seen a great many more suprapubic cuts done by his friends, and had heard of but two deaths. It is sometimes said that this operation is a dangerous one. He thought, however, this statement to be based upon inherited opinions and prejudices. It usually was not the case in his personal experience and observations.

Drainage.—Many cases occur in which it is advisable to preserve a permanent drainage from the bladder. This may be demanded, *inter alia*, for chronic diseases of the mucous membrane, or for obstructive enlargement of the prostate gland. The problem of the preservation of a permanent fistula, practically the formation of a new urethra by the method of Dr. Hunter McGuire, of Virginia, had greatly interested him. He had in many instances resorted to this drainage through a suprapubic fistula, which had in time become a satisfactory permanent new urethra. This he had successfully brought about by the daily insertion of short, flexible, block-tin, female catheters, of sizes proportioned to the calibre of the fistula, and bent or curved according to its direction. These he left in for a few hours, for a day or two at a time, until the new channel becomes callous, and accustomed to the passage of urine. Then a silver tube, of the size and curve arrived at, may be substituted and worn if necessary, closed with some sort of obturator, which can be loosed and withdrawn when necessary. In this manner leakage of urine in many cases may be practically overcome. Left to itself, the urine in the bladder accumulates, until the level of the artificial vesical opening is reached. Then escape of urine (leakage) will happen. Very often, however, the patient will first experience some strange, undefined desire to get rid of the contents of the bladder, which

may be accomplished by the insertion of a short catheter, or by opening the vent of the one already worn in position.

By these means, the patient can obtain a fairly good urethra, and in cases of prostatic hypertrophy, one is able to discard, as it were, the enlarged prostate, leaving the patient to draw off his own urine through this short, artificial urethra, comfortably and at his pleasure.

He had a patient, seventy-eight years of age, on whom he established, five or six years ago, an artificial urethra, after removing two stones by the suprapubic method. He has since passed all his water through the artificial canal, none by the natural urethra. He does not wear any permanent tube, but draws off his water as required; when he goes to bed at night, in the morning, again about his time of luncheon, and when he goes home for late dinner. He wears a small pad for safety's sake, but there is no leakage.

Dr. Brinton performed, years ago, a like operation, with equally good results, on a man fifty odd years of age, who still farms himself a tract of land of 160 rather barren acres, near the North Carolina coast. He has never, since the operation, passed a drop of water through the natural channel, and has not been troubled, in any way, with his enlarged prostate.

He had sometimes asked himself, What would I have done, if I were so unfortunate as to have, beyond peradventure, a calculus in my bladder? His answer to such a self-directed question would be briefly this, If the stone were a small one, and a soft one, he would have it thoroughly crushed, and try and pass it, *per urethram*, or possibly, if he could command the services of a skilful surgeon, whom he could trust, he would, perhaps, have it washed out. If, however, he had reason to believe that the stone was large or hard, or both, he would unquestionably have the high operation performed, since by the choice of this operation he firmly believes that less risk to life would be incurred, and that the operation, if successful, would be more apt to be final and happy in its results.

In conclusion, Dr. Brinton inquired whether any member present had ever observed evil consequences follow the X-ray examination of the bladder. He asked this question for this reason: Some time since he was present at such an examination, made on the person of a man suspected of stone, which repeated

previous searchings with the sound had failed to realize. The examiner was an expert, and the exposure about twenty-three minutes, with a negative result. Later the calculus was detected by the sound, and extracted by the suprapubic method. Several days afterwards a slough occurred around the wound, which involved the subcutaneous tissue and skin and travelled down in front of the bladder. The patient recovered, but the complication was an annoying one, although he could not speak positively as to its cause; which may have been some subtle influence of the rays, or slight urinary infiltration, or both causes acting together. He should say, however, that the drainage from the bladder was at all times good.

DR. W. W. KEEN said that he thought the choice of operation depends much on the age and the general health of the patient, as well as the size and character of the stone. If he were to choose between litholapaxy and suprapubic cystotomy, and the patient were an old man and in feeble health, he would not do a litholapaxy. As a rule, in these cases the kidneys are not sound,—indeed, they may be very much diseased,—and the prolonged use of any anæsthetic, and the necessary shock that follows it, make suprapubic cystotomy very much preferable to litholapaxy. In a man with a moderate-sized stone, in vigorous health and relatively young, he would choose litholapaxy.

As to the rules laid down by Dr. Brinton with reference to the size and character of the stone, he agreed with him, but the question of age he did not touch upon. He thought his remarks as to the quantity of water with which the bladder should be distended are very much in point, and it would be well for all to heed them. The normal capacity of the bladder, of course, should be ascertained, and before applying suction to the bladder a fixed amount of water should be allowed to escape, in order to avoid the possibility of over-distention or rupture of the bladder.

For distending the bladder, however, he thought air to be much safer, especially in older persons, air being more elastic and less likely to damage the walls of the bladder. He had not found any difficulty in reaching the bladder when it was distended with air. It makes a very firm support. He liked the rectal bag, at least where one has to deal with the posterior wall of the bladder. He had found one advantage, that when an incision was made into the bladder the wound was not flooded with

water, but one can very quickly catch the walls of the bladder, and further manipulations can be carried on as desired. He did not think it necessary to suture the walls of the bladder to the abdominal wound. He had never done so, but had found that the wound is very quickly soldered together, and establishes a thorough protection against sepsis.

The drainage he had usually employed had been that which was devised by Cathcart, and he had found it, not only in the bladder, but in abdominal, thoracic, and other cases, to be very useful. It was more effective in his hands than any other method.

In reference to the question of the X-rays, he thought surgeons should be very careful as to their use, as there had been so many cases of burn reported,—in other words, he was very much inclined not to be willing to use the X-rays, at least in any case where a prolonged exposure was demanded, as in cases where the thickness of the parts is very great, without having a paper signed by the patient himself, assuming all liability if any injury should follow. In the very best hands such accidents have occurred, and there is now pending in this city a suit for such a burn. It is not the surgeon, it is not the X-ray operator who is responsible,—it is one of the things that no one can foresee. If the patient would not be willing to assume the responsibility, he would decline to use the X-ray.

The method which has been adopted recently by Cordier in skiagraphing stone in the bladder deserves mention. By inserting a narrow plate like an ordinary microscopic slide, suitably protected, into the rectum, in a man, or the vagina, in a woman, so that no poisonous effects would be produced, and by placing the tube above the abdomen, he has obtained most satisfactory results. It is not only suitable for cases of stone, but also applicable to foreign bodies in the bladder.

DR. DEEVER said that, in cases of stone in the bladder, he favored litholapaxy with very few exceptions. He had done a number of operations for litholapaxy, and had lost but one patient. That was an old gentleman, about seventy-six years of age. He made an autopsy in the case, and found a hydronephrosis of the right kidney and a contracted left kidney, with a very large cyst involving the ureter. That man would have died, litholapaxy or any other operation.

There are certain cases where litholapaxy is out of the ques-

tion, but in the majority of cases it is the operation. He would not cut for a stone when it could be crushed and he could go to business in a few days thereafter.

Of all operations, in that of litholapaxy the patients should be profoundly anesthetized, to make the parts amenable to manipulation. It is only necessary to have two or three ounces of water in the bladder. He always went short of distention. With regard to evacuation, he used very little motion,—very little pressure. He was governed by the force necessary to bring the fragments into the bulb of the evacuator.

In regard to the question of death, there is no doubt but that prolonged etherization is a factor, but if one examines the statistics of the two operations the cutting operations are attended by higher mortality than the crushing operation.

Another strong point in favor of the crushing operation is that the patient will agreeably submit to crushing, where he would not submit to cutting, and while there are very few cases of fistulæ following the suprapubic or perineal operations, it does occasionally occur. He had often thought of the remark of Dr. Agnew, that he could not see the philosophy of going to the top of a house and breaking through the roof, while he could enter through the cellar door, and he believed that perineal drainage is best, except in the presence of a very large prostate gland.

INTERSCAPULO-THORACIC AMPUTATION.

DR. ROBERT G. LE CONTE read a paper with the above title, for which see page 260.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. Rabies and its Preventive Treatment. By FALLEN CABOT, M.D. (New York). The author, who is assistant bacteriologist to the New York City Department of Health, after studying reports of cases from Germany, Austria, France, and England, and of investigations which have been made in those countries, reports that he is convinced that the disease, though rare in the human subject, is comparatively frequent in certain animals, and is deserving of serious attention. During the year previous to this report, made in February, 1899, thirty-four persons who had been bitten by animals applied to the Laboratory of the New York Board of Health for treatment. In nineteen of these cases investigation showed that there was little or no reason for presuming that the biting animal had been suffering from rabies. Of the remaining fifteen, in twelve the dog was proved to have been rabid, in one the dog was proved not to have had rabies, and in two the animal was not obtained for experiment. To all the fifteen the Pasteur preventive treatment was given; all these, with one exception, remain in good health. The one exception was in the case of a woman who had received twenty-eight bites on her hands and arms, the wounds being deep and the tissues severely lacerated. The patient did not present herself for special treatment until thirty days had elapsed, when most of the wounds had healed. The Pasteur treatment was then begun, but before it was completed—namely, in the forty-seventh day after having been bitten—she developed symptoms of rabies, which terminated in death during the third day thereafter.

He recommends the following procedure in cases of individuals bitten by an animal:

Obtain the history of the animal as far as possible. If the locality where the patient was bitten had been the seat of other cases recently, and the wound was in an exposed part of the body, hand or head, cauterize thoroughly within twenty-four hours, using an anæsthetic and nitric acid. If the wounds were severe, give Pasteur preventive treatment; if the bite was superficial or through the clothes, and the cauterization was made thoroughly within twenty-four hours, nothing more would be required, certainly not if there had been no cases of rabies in the neighborhood.

The Pasteur preventive treatment can never do harm, and if the patient desires it, it should always be used. It is given in the following way: The spinal cord of a rabbit dead from laboratory rabies is hung in a sterile jar with two vents, one in the lower and the other in the upper part, both filled with absorbent cotton. In the bottom of the jar is placed a few sticks of caustic potash to aid the drying process. The jar is kept in a dark room, at a temperature of 68° to 72° F. A portion of the cord thus prepared is emulsified by the gradual addition of sterile water and by means of a glass rod. A cord dried fourteen days is the one used for the first injection, and then each day a fresher cord is employed until one dried only three days is finally used. The dose of the emulsion for the older cords is three centimetres for adults, and then, finally, one and a half centimetres for the fresher ones. The injections should be given under aseptic precautions, either into the subcutaneous tissue of the abdominal wall or the buttock, care being taken not to penetrate the muscular tissue. No particular reaction, either local or general, should follow the injections. Before the cord is emulsified at least two tests should be made to prove its freedom from any chance contamination. The usual course of treatment lasts fifteen days, in which time twenty to twenty-five injections are given. If the subject comes late, or if the injury is very severe and near a large nerve, the intensive form of treatment may be employed. In this way more injections

are given daily, thus rapidly approaching the time to use virulent cords. Children bear nearly as large doses of the cords as adults.

Animals which have bitten people should never be killed, but captured, and placed in a kennel under lock and key for a week. If at the end of that time they are well, there is naturally no danger for the person bitten. If the animal dies, an autopsy should be made, all the organs examined, and a portion of the brain and spinal cord emulsified and inoculated into guinea-pigs and rabbits. If a disease which could cause death should be found in other organs, it is of importance, but one should also make the inoculation-tests to demonstrate beyond a doubt that rabies was not also present in the same case. In this way it could be said truthfully that, according to the result of the autopsy and tests, the animal did or did not have rabies.

As the result of a large number of experiments, involving 287 guinea-pigs, the author came to the following conclusions:

(1) That 91 per cent. of guinea-pigs can be prevented from developing rabies if the wounds be cauterized with chemically pure nitric acid at the end of twenty-four hours from the time of infection, probably a larger percentage if the cautery be used earlier. (2) That fuming nitric acid is more effectual than the actual cautery or pure nitrate of silver. (3) That some degree of benefit is derived from thoroughly opening and swabbing out an infected wound within twenty-four hours from the time of infection when no cautery is used. (4) That in cases in which the Pasteur treatment cannot be applied great benefit may be derived from the correct use of the best cautery and proper treatment of the wound. Even in cases in which the Pasteur treatment can be given, early cauterization will be of great assistance as a routine practice, and should be very valuable, as the Pasteur treatment is frequently delayed several days for obvious reasons. (5) That in the case of small wounds all the treatment probably indicated will be thorough cauterization with nitric acid within twenty-four hours from the time of infection. (6) That from 12 to 16 per

cent. of the guinea-pigs used as controls do not die after inoculation, thus demonstrating that a small percentage of guinea-pigs have a natural immunity from rabies.—*Medical News*, March 18, 1899.

II. Intracerebral Injections of Antitetanic Serum. By M. QUÉNU (Paris). The reporter related in detail four cases of tetanus, and briefly refers to a fifth case, all hitherto unpublished, in which resort was made to intracerebral injections of antitetanic serum, but without favorably influencing the course of the disease in any case.

In the first case, a patient of M. Beurnier, a woman, forty years of age, the first tetanic symptoms had declared themselves eight days after the receipt of an abrasion of the knee; on the fourth day of the disease, by which time the intensity of the tetanic symptoms had become great and the exhaustion marked, a lumbar puncture of the cord was made, and, after the evacuation of twenty cubic centimetres of cerebro-spinal fluid, forty cubic centimetres of antitetanic serum were injected. No amelioration following this injection, an intracerebral injection of eight cubic centimetres was made later on the same day. By the next day the tetanic crises had become more rare, and the dyspnœa had disappeared. By the following day, the second after the injection, complete relaxation was present, but the patient was comatose, and remained so until death, which took place at the close of that day.

In the second case, observed by M. Veslin, a boy, sixteen years of age, developed tetanus thirteen days after having received a gunshot wound of the ankle. On the third day of the disease, the symptoms having become aggravated, four cubic centimetres of antitetanic serum were injected into each frontal lobe. A temporary improvement followed, manifested by disappearance of trismus and of the contracture of the posterior muscles of the neck. By the next day, however, these symptoms reappeared, general spasmodic crises developed, and the boy

died during the afternoon. The third case was treated by M. Quénu, at the Hospital Cochin. The patient was a man, fifty-two years of age, who, while under treatment at his home for fracture of the neck of the femur, developed extensive and multiple bedsores, and finally tetanus, for which latter condition he was brought to the hospital about three days after the appearance of the tetanic symptoms. At that time the trismus was very pronounced, but there was no contracture of the extensors of the neck or back, no embarrassment to respiration nor to swallowing. A bilateral trephining was done, and two cubic centimetres of serum injected into each side, while the bedsores were curetted and washed with oxygenated water. For two days thereafter his condition remained unchanged; on the third day he developed a double pneumonia, which proved fatal on the fifth day, by which time also an increase in the tetanic symptoms had appeared.

The fourth case was that of a man, forty-eight years of age, who had run a splinter into one of his fingers. The little wound suppurated, and fifteen days later the first signs of tetanus appeared. On the fifth day of the disease he was brought to the hospital and seen by M. Quénu. The trismus was then marked, and there was contracture of the extensors of the neck and back; the abdominal muscles were somewhat affected, the abdomen being scaphoid. The limbs were free. Two and a half centimetres of serum were at once injected into each frontal lobe. No particular phenomenon resulted from this procedure. The next day was marked by muscular twitchings and crises of dyspnoea, in one of which he died.

M. Quénu refers also to a fifth unpublished case, related to him by Dr. Larrien, of Constantinople. A child, fifteen years of age, who was trephined and injected on the fifth day after the development of tetanus, died seven hours later.

There were no accidents referable to the injections themselves in any of these cases. No headache nor disturbance of sensation or motion was experienced by the patients.—*Bulletin et Mémoires de la Société de Chirurgie de Paris*, 1899, t. xxv, p. 254.

III. A Case of Recovery from Acute Tetanus after Intracerebral Injections of Antitoxin. Death later from Cerebral Abscess. By WILLIAM F. GIBB, M.D. (Paisley). The patient, a boy of thirteen years of age, received a severe crush of the hand, for which ten days later amputation of four fingers at the metacarpo-phalangeal joints was done, at the Paisley Infirmary. Much suppuration and advancing local infection followed until the seventeenth day after the accident, February 25, 1899, when there was constant and severe pain in the hand, and frequently acute shooting pains extending to the shoulder. On the previous night he several times started up, and suddenly threw himself back in bed. This morning there was marked stiffness of the lower jaw, and he was unable to separate the teeth more than half an inch. There was no dysphagia. There was slight retraction of the head and opisthotonos, which disappeared during sleep. The whole of the right upper extremity was perfectly rigid, with the forearm semiflexed. This condition was unaltered during sleep, and, it may here be added, persisted long after the other symptoms. While awake the eyes remained half closed, and the angles of the mouth drawn downward and outward. The breathing was rapid (40) and shallow; the pulse was regular, and of good tension; its rate was 100 to 120. He took food well. The evening temperature was 97° F. Chloral was given in doses of ten grains every four hours.

February 26: There was no improvement, and he had been excited and noisy during the night. At 2 P.M. ten cubic centimetres of antitetanic serum (from the Pasteur Institute) were injected under the skin of the abdomen. At 6 P.M., under chloroform, eight cubic centimetres of serum were injected into each frontal lobe, four cubic centimetres from the middle line, and four cubic centimetres above the supraorbital ridge, corresponding closely to the frontal eminence; each injection occupied ten minutes. For the operation a dental drill and an ordinary antitoxin syringe were used; the wound was closed by collodion without suture. In addition fourteen cubic centimetres were given hypo-

dermically. While on his way to the operating table the patient had a severe spasm, affecting the neck, back, and lower limbs. At 9 P.M. he was noisy, and tried to get out of bed. At 10.30 P.M. ten cubic centimetres of the serum were given hypodermically.

February 27: He had had a restless night. The head was slightly retracted and the jaw rigid. Respiration was shallow (44) and mainly abdominal. At 7.30 P.M. ten cubic centimetres were injected hypodermically.

February 28: He had had a quiet night, but seemed no better. He could only separate his teeth a quarter of an inch. He was troubled with mucus collecting in the mouth and throat. He swallowed milk well. There was severe spasm of the neck and back. The pulse was feeble (112), and the respirations 48. The stump was healing slowly.

March 1: He had a good night, but there was no improvement of the tetanic symptoms; the jaw was almost fixed. The thoracic walls were quite rigid, and the respiration was purely abdominal, with a rate of 52 to 60. The pulse was soft and feeble (112). He took liquids freely. At 9.30 P.M. ten cubic centimetres of serum were injected into each frontal lobe.

March 2: He was restless and noisy for half the night, and no better in the morning. At 7 P.M. twenty cubic centimetres of serum were given hypodermically. Temperature 100° F.

March 3: The spasms were rather less severe, but the boy was drowsy and weak. The pulse was 116 and feeble; respirations 68. There were frequent attacks of choking, from tough mucus accumulating in the pharynx and larynx. There was no difficulty in swallowing milk. He was given twenty cubic centimetres of serum hypodermically. The midday temperature was 103.2° F.

March 4: He rested well last night. The jaw was somewhat relaxed, but the head continued retracted. He slept almost constantly. The respirations were 68 and the pulse 120; the midday temperature was 103.6° F.; there was incontinence of urine and

fæces. At 7 P.M. a hypodermic injection of twenty cubic centimetres of serum was given.

March 5: There was severe spasm of the jaw, neck, and back. At 2 P.M. he received fifteen cubic centimetres of serum by intracerebral injection. Shortly after he was extremely weak, but rallied towards evening. The administration of chloral was stopped at 2 P.M. At 4 P.M. the temperature was 103.2° , the pulse 128, and the respirations 68.

March 6: He was restless, excited, and noisy last night; he tried frequently to throw himself out of bed. Chloral was resumed at 1 A.M. in the same doses. At 10 A.M. he was much quieter. The left pupil was widely dilated, and responded sluggishly to light; the right pupil was moderately dilated, and responded promptly. He was quite unconscious, and could not be roused by speaking loudly, but by pinching he could be half wakened. While sleeping the lower jaw could be moved passively, but tended to become rigid. Apart from this and the rigidity of the right arm there was no spasm. At 4 A.M. the temperature was 101.8° F., the pulse 124, and the respirations 60.

March 7: He was still unconscious, and could not be perfectly roused. The pulse was 116, and stronger; the respirations were 52, and the noon temperature 99.8° F. By the afternoon he became conscious, and even intelligent.

March 8: He was obviously improving. The temperature was 100.8° F., the pulse 112, and the respiration (which was entirely abdominal) 48; the pupils were equal. At 6 P.M. a single intracerebral injection was made into the right frontal lobe.

March 11: He was much distressed by hawking up tough mucus, which he expelled with great difficulty on account of spasm of the masseters. The chest continued rigid, so that breathing was still chiefly abdominal. The respiration-rate was 40, the pulse-rate was 96,—it was of good tension; the temperature was 101.4° F. At noon he had the last injection of ten cubic centimetres, which was given into the right frontal lobe.

March 15: All tetanic symptoms had subsided. The later convalescence was uncomplicated.

The reporter calls attention to the long period after the beginning of the antitoxin treatment before improvement began to become manifest. Nine days thus elapsed, and on the fourth and fifth of these days the patient's condition appeared wellnigh hopeless. The quantities of serum given amounted to seventy-one cubic centimetres by intracerebral, and 104 cubic centimetres by hypodermic injection. Apart from a scarlatiniform rash over the abdomen, lasting three days, the injections produced no ill effects. —*British Medical Journal*, April, 1899.

The sequel in this case is given in the *British Medical Journal* of July 1, as follows:

April 6, 1899, the patient was obviously gaining strength, and was able to be out of bed a short time daily.

April 8. He complained of headache, chiefly frontal, with vomiting. The temperature was normal. Repeated doses of calomel, three grains, followed by seidlitz powder, were given. In eight days there was complete relief of the headache and vomiting (April 19). From this date he improved steadily for nine days, when he appeared again to be convalescent, and was able to be out of bed on two occasions.

On April 28 the headache and vomiting recurred, and on the 29th there was a slight rigor.

On May 31 he seemed better. On the 4th he became for a short time collapsed and unconscious; on partially recovering he shrieked several times. There was for a brief interval spasm of the right arm and hand, and of the left leg and foot, with opisthotonos. Common sensation in the right leg varied remarkably; at one time pinching produced no response, at another the leg was withdrawn. Twitching of left fingers, hand, and arm, and of the left leg occurred on one occasion. Double optic neuritis was observed. The boy remained quiet, and for the most part unconscious, and died at 8 A.M. on May 5, 1899.

Post-mortem.—The convexity of the hemispheres presented a normal appearance over the posterior and middle lobes. The frontal lobes on both sides, but more markedly on the left, showed distinct bulging, with flattening of the convolutions and partial obliteration of the sulci. On section of the brain substance abscess-cavities were revealed on each side, situated deeply in the centre of each lobe. That on the left was about the size of a hen's egg and contained about two ounces of thick yellow pus. This cavity was in communication with the left lateral ventricle, into which pus had passed; it also communicated through the great transverse fissure with the cerebellar fossæ. The cerebellum was bathed in pus, which had also passed into the perimedullary spaces. The abscess-cavity proper was surrounded by a zone of deeply congested cerebral tissue, which could be traced posteriorly backward and downward towards the internal capsule. On the right side the abscess-cavity was about half the size of that on the left, and its walls showed less evidence of acute inflammation. It contained about one ounce of pus. The brain seemed otherwise normal.

HEAD.

I. Osteoma of the Lower Jaw. By DR. ERICH ECKERT (Breslau). Osteomas are among the rarer varieties of tumors of the jaw. Birnbaum found it once in fifty-nine; Windmüller, twice in 137; Bayer, once in sixty-five. A number of so-called osteomas are in reality leontiasis ossea, ossifying enchondroma, osteosarcoma, and bone-cysts.

A unique case observed by Mikulicz calls forth this article. The history is as follows: A female, aged fifty, nine months ago suddenly noticed a distortion of the face, with a deviation of the chin to the left. The apposition of the teeth is no longer perfect. This condition is attributed to a sudden twist of the neck incident to pushing a door. The onset was with severe pain, unrelieved after visiting many clinics. At present a cracking noise is heard

during mastication, and has pains radiating into the ear and down to the shoulder. The patient is otherwise healthy; has the appearance as if a paralysis of the facial existed, and the right ramus ascendens appears longer than the left. No difficulty in mastication or articulation of sounds. The right maxillary articulation is thickened, and crepitation is heard during mastication. The interval between the mastoid and the maxilla is deepened, owing to a deviation of the right ramus to the left. Nothing is felt per os, and the Röntgen rays merely show the existence of a growth near the joint. Neither its character nor its connection with either joint-surface could be established. Iodide of potassium, administered for eight weeks without effect. Operation: Resection of the maxillary articulation; healing by primary union; and five months later the function was perfectly restored and the scar scarcely visible. The specimen obtained is an osteoma, the size of a plum. The nineteen cases herein tabulated mostly affect youths, and both sexes equally. Traumatism or operations on the jaw are credited as factors, and inflammation of teeth and fistulæ, and operative interference for these so often mentioned, warrant a causal relation. The growth takes many years to attain any size, and is not associated with any pain. It has to be differentiated from sarcoma, cysts, osteitis, and periostitis. The prognosis is good. The therapy is purely surgical,—removal; and, in the event of any suspicion of syphilis, mercury and iodide of potassium should be administered.—*Beiträge zur klinischen Chirurgie*, Band xxiii, Heft 3.

II. Exostoses of the Lower Jaw. By PROFESSOR DR. F. HOFMEISTER (Tübingen). Statistics as to the seat of osteomas show them to have a predilection for the jaw, yet, in spite of this predisposition of the jaw for producing bony neoplasm, enormously deforming exostoses are among the rarities seldom encountered. Such an interesting observation, possibly affording an assumption for the origin of these tumors, emanates from the clinic of von Bruns.

History.—A girl, aged twenty-seven. At fourteen years, following exposure to cold, the inferior maxilla became swollen and very painful; six weeks later pus evacuated spontaneously. This fistulous tract still exists. The swelling was stationary for five years, aggravated at times by attacks of erysipelas. In this interim a second fistula formed, at the bottom of which bare bone could be felt. Sequestra were removed, the largest the size of an eye, but no teeth were extracted. The tumor involved the entire left half of the inferior maxilla, the skin over it was infiltrated and ulcerated, and through the ulcer masses of pointed and rounded bone extruded. Mastication was very difficult and the rear molars are missing.

Operation.—Subperiosteal resection. The specimen obtained showed the jaw healthy as far as the bicuspid, but the remainder a rugged mass of bone. A large cavity on the inner side harbors a sequestrum. The outer side has the appearance of stalactite. The consistency of the new bone is porous. The weight of the growth is 250 grains. In the soft parts seventy loose particles of bone were found of the same consistency as the osteophytes.

The principal features of this clinical picture are its incipency in an acute inflammation with an increase in consistency, but not in size. The fistulæ discharged at all times, and there were no subjective phenomena except occasional attacks of erysipelas. These facts have an intimate bearing on the relationship of inflammations to this form of tumor, and in accord with this theory are the opinions of C. O. Weber, Virchow, and Volkmann. This case, with its enormous bony masses, began as an acute infectious osteomyelitis, but the sequestrum found, its size equal to the jaw, yet thicker than it, and its structure of different consistency than the bone of the jaw, showed the necrosis to have taken place in newly formed bone. The final explanation of the condition is that the necrosis provided irritation for the new formation of bone, but when the first sequestrum was eliminated, the irritation spent itself on the newly formed bone, causing in turn its necrosis. An

additional remarkable feature is the presence of isolated masses of bone in the soft parts. Some of the masses of bone were formed from periosteum, some from the diplöe. In conclusion, the author cites similar cases of Albert and Kaliso, and also a case of Berger, reported as osteoma, though it started as with signs of acute inflammation.—*Beiträge zur klinischen Chirurgie*, Band xxiii, Heft 3.

MARTIN W. WARE (New York).

ABDOMEN.

I. Results of Operations for Carcinoma of the Stomach in the Berne Clinic. By PROFESSOR KOCHER (Berne). The author has resected the pylorus in fifty-seven cases. The results of these cases have been as follows: One, a woman, is still living, ten years after the operation; another, five years after the operation; a third, three years; another patient, a man, two years after the operation. Four other cases died from accidental causes or from other diseases after three years had elapsed. These cases must be regarded as cured. Kocher's procedure, resection, occlusion of the stomach, and gastroduodenostomy was used in thirty cases. Five fatal cases which occurred cannot be attributed in any way to his method. Kocher condemns the Murphy button, because we must then rely upon the manufacturer and upon circumstances. In one case in which it was used it was found in the stomach eighteen months after operation; in three cases perforation occurred.

Kocher uses strong forceps in closing the lumen of the stomach, and intestine instead of using digital compression. As an intestinal suture he uses silk exclusively.

The author calls attention to the fact that the prognosis is at present much more favorable than it was in the past. The statistics of Ewald, Hacker, and others are misleading in that they place the mortality too high. In order to still further lower the mortality it will be necessary that patients be placed in the hands

of the surgeon earlier than has heretofore been the case. This is true in ulcer as well as carcinoma. At times carcinoma can only be diagnosed by the resistance present while the patient is deeply anesthetized. In cases of gastric ulcer the "internal" physicians often do harm by continuing treatment though no improvement is shown. The existence of free hydrochloric acid does not exclude the diagnosis of carcinoma.—*Korrespondenzblatt für Schweizer Aerzte*, 1898.

II. Fontan's Method of Establishing Gastric Fistula.

By M. RICARD (Paris). Taking as a text a gastrostomy successfully performed by Loisson, the author discusses the various methods. He particularly recommends Fontan's procedure as performed by Loisson in the above case, and used by the author in four cases. The stomach is exposed by an eight centimetre incision parallel to the costal arch and two centimetres distant from it. The stomach is caught up by a pair of forceps, drawn well out into the wound, a conical portion projecting above the level of the abdominal wall. The base of this cone is securely fastened to the parietal peritoneum at the wound edges, thus closing the general abdominal cavity. The apex of the cone, to which the forceps are attached, is now inverted like a glove-finger by crowding it downward and backward. The serous surfaces touching each other around the forceps lying in the canal are now sutured, the clamps withdrawn, the inverted apex of the cone perforated by a knife, and a tube introduced into the stomach. Ricard prefers making an opening into the stomach before inverting the cone, as an injury might be easily produced otherwise.

[This procedure corresponds to Kader's method, the only difference being that Kader sutures the stomach to the abdominal incision after the fistula has been formed. Kader is not, however, mentioned by the author.]—*Bulletin et Mémoires de la Société de Chirurgie de Paris*, t. xxiv, p. 439.

RUSSELL S. FOWLER (Brooklyn).

III. The Excision of Hæmorrhoids. By DR. GEORG REINBACH (Breslau). The author hopes to adduce evidence in these few lines that the method as practised at the Mikulicz clinic is productive of the best results. In the main it is identical with Whitehead's operation (1887).

Whereas English, American, and French surgeons early gave their support to the Whitehead-Lange operation for hæmorrhoids, it was not till 1893 that Sendler, in Germany, described his successful operative results for hæmorrhoids by a method identical with Whitehead's, which he had independently conceived and practised for several years. Yet as late as 1896 the consensus of opinion at the German Surgical Congress was in favor of the Paquelin cautery.

In the latter part of 1893 Mikulicz abandoned the Paquelin for a new method (also claimed for him by the author), which was more in keeping with the endeavors of the day to attain primary union wherever possible in lieu of healing by granulation. The preliminary preparation consists in the administration of oleum ricini three days before operation, and restricted diet. On the evening before and on the morning of the day set for operation rectal irrigations with boric-acid solutions, followed by tincture opii, ten to fifteen drops. The lower third of the rectum is covered with a paste made of iodoform, and 3-per-cent. carbolic solution. The subsequent technique differs from Whitehead's as follows: The sphincter is not stretched to the point of paralysis, the anus is merely dilated enough to bring the hæmorrhoids into view. Hæmostasis is solely accomplished by suture. No ligatures are used, as the intact sphincter aids in the compression of the vessels. The absence of ligatures eliminates an additional risk of infection. The suture is made with catgut instead of silk. A very important innovation is the removal of blood during the operation by a continuous irrigation with cold boric-acid solution. The use of sponges is interdicted, because of the danger of the mechanical forcing of germs into the interstices of the tissues.

The line of suture is dressed with a paste of iodoform spread on gauze. The bowels are moved for the first time on the tenth day, being kept costive by the administration of opiates. The presence of phlebitis, thrombosis, and ulceration are contraindications for the performance of this operation. The merits of excision are that it is radical, effects a primary union, is technically simple and easy, and no strictures follow in its wake. This report is based on eighty-one cases controlled from one to five years, with no account of recurrence.—*Beiträge zur klinischen Chirurgie*, Band xxiii, Heft 3.

MARTIN W. WARE (New York).

EXTREMITIES.

I. Traumatic Gangrene from Rupture of the Inner Coats of the Arteries. By DR. ULRICH HERZOG (Tübingen). This special variety of injury, having been neglected in textbooks, the author is induced to gather data on this subject, following an experience of von Bruns thus detailed:

A mason, aged thirty-two, had his left thigh and knee compressed between the trunk of a tree and a moving log. He was able to walk home, and was treated for a contusion. Three days later, on admission, he had a slight fever, a discoloration from the middle of the thigh downward, and this extent of the limb cold and anæsthetic. No motion of the toes. No fracture nor wound; in the middle of the left leg a line of demarcation. No pulsation in the popliteal. Five days later the gangrene progressed. Amputation (Gritti). A thrombus was found in the popliteal artery. In the amputated limb the media and intima were found torn circularly and rolled up. Adventitia intact. Above the laceration a thrombus. A rupture of the inner coats can cause either thrombosis or aneurism. The latter more frequently sought for. Many cases of gangrene attributed to improper treatment may be due to contusion of the vessels. The intima, as the weakest coat, is most likely to tear, then the media, and last the adventitia. Ath-

eromatosis and the exposed position of vessels favor rupture. Thus the brachial was injured eighteen times, the axillary, seven; popliteal, fifteen; femoral, eight; common iliac, aorta, posterior tibial, and subclavian, each two times; the external iliac, four times. The carotid, radial, and ulna each once. The axillary is often injured in association with dislocation of the humerus. Directly responsible for this injury is a bluntly acting force spending its violence on a vessel aided by traction. The latter factor alone may accomplish this, as proven by autopsies on bodies of suicides from strangulation, and those dead from hanging. Fractures and dislocations are the most common complications. Ruptures of muscles and lacerations of vessels and nerves are also encountered. The laceration of the coats is transverse, and the roughened and rolled up coats cause thrombosis. Symptoms are momentary pain, absence or weakening of the pulse with a blowing murmur at the site of the laceration. In the diagnosis, false aneurism has to be excluded. If collateral circulation is not established, gangrene sets in. Gangrene is the more likely termination if adjoining structures are affected. Other factors in the prognosis are age, presence of atheroma, and injury to the principal vein.

Treatment must be solely directed towards favoring the circulation by elevation of the limb and with the onset of gangrene; amputation at the level of injured vessel.

Sixty-one cases are tabulated; of these, twenty-one terminated in gangrene with anatomical evidence of rupture; ten terminated in gangrene with no anatomical evidence; twenty-three went on to recovery; and seven resulted in death due to complications.—*Beiträge zur klinischen Chirurgie*, Band xxiii, Heft 3.

MARTIN W. WARE (New York).

REVIEWS OF BOOKS.

TRANSACTIONS OF THE AMERICAN SURGICAL ASSOCIATION. Vol. xvi. Edited by DE FOREST WILLARD, M.D., Recorder of the Association. Philadelphia: W. J. Dornan, 1898.

This volume represents the same high order of scientific work which we have become accustomed to expect from the American Surgical Association. This association stands for the best of American surgery, and it is always with a sense of pride that we review its work.

The present volume of transactions presents a series of excellent papers, fifteen in number. Surgical questions of timely interest are discussed. Senn has a paper on the etiology and classification of cystitis, in which he makes a classification based upon the anatomical location and upon the etiology of the cystitis. In the first category he describes pericystitis, paracystitis, interstitial cystitis, and endocystitis. Under the bacteriological classification we find cystitis due to bacillus coli commune, saprophytic (mixed) infection, staphylococcus infection, streptococcus infection, erysipelalous cystitis, typhoid infection, diplobacillus infection, gonococcus infection, and tubercular cystitis.

The question of operative interference in recent simple fractures of the patella is considered in a very able and carefully prepared paper by Powers. The diversity of opinion and practice among surgeons with regard to this question is striking. As surgical technique becomes more and more perfected the operation is steadily gaining advocates, but even yet its champions are all too few; and the last word has not yet been spoken.

Fowler presents the subject of the use of animal toxins in the treatment of inoperable malignant tumors in a paper which

brings this subject up to date, embodying, as it does, a review of the literature and his own personal observations.

Halsted contributes a clinical and histological study of certain adenocarcinomata of the breast, and a brief consideration of the supraclavicular operation, and of the results of operations for cancer of the breast at the Johns Hopkins Hospital from 1889 to 1898. In this paper appears the new surgery of carcinoma of the breast, the originator and advocate of which is Halsted, and which is characterized by operative dissections, the extent and thoroughness of which have never before been equalled.

Other papers are on the etiology of cancer, by Park; remedial measures in obstruction of the common bile-duct, by Gaston; traumatic rupture of the pancreas, by Cushing; cranial cracked-pot sounds as a symptom of cerebellar tumors, by Carson; urinary fæcal fistula following perforation of the appendix vermiformis into the bladder, by Keen, and the report of a similar case, by Fowler; gunshot injuries of the spine, by Prewett; hysteria from a surgical stand-point, by Moore; treatment of hypertrophy of the prostate gland, by Lane; some cases not operable, by Cheever; and the cure of a case of sarcoma of the scapula by accidental wound infection, by Richardson.

This book is edited, printed, and bound with the same care and style as that which characterizes the preceding volumes.

JAMES P. WARBASSE.

TEXT-BOOK OF OPHTHALMOLOGY. By DR. ERNEST FUCHS, Professor in the University of Vienna. Translated by A. DUANE, M.D. Second American Edition. New York: D. Appleton & Co., 1899.

Dr. Fuchs's text-book has already impressed itself in the minds of the American profession as being a volume of great worth, and the present edition will not be the less acceptable. While, as the translator states, revision is almost to be found upon every page, the principal change and addition are in

the sections on "functional examination," the pathology of corneal and conjunctival diseases, and the diseases of the fundus. Eighty new illustrations have been added. Glancing at the volume as a whole, many things of interest specially appeal to us, and we note a few of them.

In discussing the conjunctiva, the term "region of transition" is used to designate that loose or reserve portion situated at the apex of the cul-de-sac, an expression not found in our American text-books on anatomy and ophthalmology.

In the use of nitrate of silver a 2-per-cent. solution, or ten grains to the ounce, is advised for routine use, the two- or five-grain solution being in much more constant use in this country.

The author does not believe that corneal ulcers form a contraindication for the use of nitrate of silver; on the contrary, they furnish a direct indication, if the ulcers be of catarrhal origin. He is evidently not a believer in the modified use of Credé's method, as some advocates here, but expresses himself strongly in favor of its indiscriminate use in all cases.

The acceptance of atmospheric contagion in the etiology of trachoma is discarded, the writer believing in direct infection from eye to eye.

The term phlyctenular conjunctivitis has been supplanted by that of conjunctivitis eczematosa, the writer believing that accumulated testimony points to its analogy with eczema of the skin.

The protective bandage is advocated as being the most important agent in the treatment of corneal ulcer, accomplishing, as it does, the immobilization of the lid, diminishing the pain, protecting from dust, and furnishing the natural support of the lid against a cornea thinned in parts of its continuity, and with a tendency to bulge. The contraindication being profuse secretion.

A 1-per-cent. solution of the sulphate of atropine is mentioned as being that mostly employed therapeutically in the eye. One-half per cent. being much nearer the standard of use in this country.

The placing of a granule of the salt in substance in the conjunctival sac is also advocated when excessive action is required. This seems heroic, but the author cautions as to toxic after-effects.

Noticeable in the construction of the book are the frequent paragraphs—sometimes pages—printed in smaller type than the regular text. This makes the book somewhat harder of reading; but whether the author considered the contents of these pages of secondary importance, or this plan has been adopted for the purpose of condensing a volume which might otherwise assume too large proportions, we do not know; but, without doubt, among them are to be found some of the brightest and most interesting writings in ophthalmology.

Notes on bacteria and their bearing on different eye-diseases are to be found throughout the volume, and in many instances the historical aspect of various conditions are discussed in an interesting manner. Attention is paid throughout to the special need of the general practitioner, and common mistakes in diagnosis and therapeutics are emphasized. The arrangement of the volume in its subject-matter is excellent. It is divided into four parts, which again are subdivided. In succession they comprise (1) examination of the eye; (2) diseases of the eye; (3) anomalies of refraction and accommodation; (4) operations. There is also an appendix profusely illustrating the instruments commonly used in ophthalmological practice.

The illustrations in general throughout the volume are good, many of them picturing pathological conditions not to be found in other text-books.

We know of no book in ophthalmology that combines the many requisites of a modern text-book as does this present volume. It is exhaustive in its research of clinical and pathological truth, and yet it is accompanied by a clear, logical, forcible style of expression, by which the writer makes himself readily understood, and gives the reader no difficulty in following him.

It teems with practical suggestion culled from a wide experience, and while touching upon almost every ophthalmological topic, it is stripped of all superfluity and deals in facts clearly, logically, and concisely expressed. There is very little of worth on the subject of the eye that is not found in essence in this volume.

As a text-book on ophthalmology, fulfilling, as it does, the needs of the student, general practitioner, and specialist, it is doubtful if it has its peer in the ophthalmological writings of to-day.

P. CHALMERS JAMESON.

CORRESPONDENCE.

REMARKS ON A PAPER ENTITLED "THE OTHER KIDNEY IN CONTEMPLATED NEPHREC- TOMY," BY GEORGE M. EDE- BOHLS, M.D.

Editor ANNALS OF SURGERY:

DOCTOR EDEBOHLS in his paper (ANNALS OF SURGERY, April, 1898, p. 425) mentioned above, in discussing nephrectomy, dilates upon the difficulties met with in determining the very important question of the condition of the kidney to be left, and upon the means of determining beforehand the exact condition of this organ. After enumerating several of the well-known methods which have this object in view, he adds a "new one,"—namely, exploratory lumbar incision. On page 428 we find the following statement:

"In the meanwhile there remains a final resource for determining the presence and the condition of the other kidney, any allusion to which in surgical literature has thus far escaped the writer, although he has heard of its having been recently resorted to, at least in part, by a prominent New York surgeon. *I refer to incision down upon, delivery, and the examination of the fellow of the kidney to be removed, previous to completing an otherwise indicated nephrectomy.* On May 23, 1894, when I first practically carried out the idea, I believed the conception original with myself, and I have found no reason up to the present to change this belief. As any claim to priority which I may have is based upon this case, I take the liberty of quoting briefly from its published report (Edebohls, 'Notes on Movable Kidney and Nephrorrhaphy,' Part III, *American Journal of Obstetrics*, February, 1895)."

In the summary towards the end of Dr. Edebohls's paper, on page 435, we read,—

"Incision down upon, delivery, and examination of both kidneys (lumbar exploratory incision), as originally proposed and carried out by the writer, should be the rule in every contemplated nephrectomy in which we are not absolutely and beyond peradventure certain of the presence and exact condition of the other kidney."

Dr. Edebohls's claim for priority in this matter is not valid, as I employed exploratory lumbar incision for diagnosis preceding nephrectomy for carcinoma on November 27, 1890. The operation was performed at Emergency Hospital during a clinic given before the students of the Chicago Polyclinic, with the assistance of Drs. Brougham, Bernauer, and others, and, as a matter of record, the case was reported in a paper entitled "Demonstration of Specimens from Operations on the Kidney, with Presentation of Patients," which was read by me before the Chicago Medical Society, February 6, 1893, and was published in the *Chicago Medical Recorder* March, 1895, on page 155.

I will give here in detail the history of the case of carcinoma of the left kidney, brief mention of which was made (Case II) in my paper just referred to:

V. L., twenty-seven years of age; Swede; tailor. Mother died at the age of fifty-five from phthisis; a sister also died of phthisis. One brother died at the age of twenty-nine from incarcerated hernia. His father, at the age of fifty-six or fifty-eight, had an operation for cancer of the lower lip, which resulted successfully, and he is still alive at the age of sixty-eight. His grandfather and grandmother were always healthy, and died at about the age of eighty-five. The patient's personal history is negative, with the exception of polyarticular rheumatism in 1881, which lasted three weeks. He came to America in October, 1887. On June 6, 1890, the patient first noticed that he passed blood in the urine, and felt tired in the region of the back while at work. The

following day he had pain, not in the left posterior renal region, but in the anterior portion of the left hypochondrium, above the anterior superior spine of the ilium, between the crest of the ilium and the border of the ribs. He consulted a physician, who made no examination, but gave him medicine. The hæmorrhage continued for about two weeks, accompanied by intermittent pain. He passed water two or three times a day, but did not have to get up at night for this purpose.

After an intermission of several days, the patient was taken with severe pain, which persisted from four to six hours, and for which hot applications were prescribed by a physician. Hæmaturia followed, whereupon the pain subsided. The pain was always in the same region,—namely, the anterior hypochondrium. It did not radiate down the ureter to the scrotum, but was localized to one spot, not larger than the point of the finger, midway between the anterior superior iliac spine and the border of the ribs. The pain was not affected by pressure. In July he became very weak, so that he could hardly walk up and down stairs. Two months later he became stronger and had a better appetite. During this time he was taking medicine. The same condition continued until November 25, but with a progressively increasing hæmaturia.

I first saw the patient on October 8, 1890. His urine contained blood. Ergot, iron, and lithia water were prescribed. On November 20 patient was sent to the hospital. At this time no tumor or swelling could be made out, but the pain in the left hypochondrium persisted.

Diagnosis.—Nephrolithiasis or tumor of the left kidney.

Plan of Operation.—Exploratory incision; lumbar operation.

On November 27, after the usual preparations, the patient was anæsthetized with ether and placed on the right side with a pillow under the small of the back. An incision, ten inches long, was made from the erector spinæ downward and forward obliquely to the anterior superior spine of the ilium, through the

skin, abdominal muscles, and the quadratus lumborum. The capsule of the kidney was opened, and, on digital exploration, the posterior portion of the kidney was found smooth and normal. Upon palpation of the anterior surface of the kidney a soft, round tumor, the size of an apple, was felt bulging out from the kidney tissue. I at first thought that this might be an irregularity in the shape of the kidney, but upon exploratory puncture, blood only was withdrawn, and no pus or stone could be made out. I therefore concluded that a malignant tumor existed and decided upon the extirpation of the kidney.

In order to ascertain before the extirpation of the left kidney, whether a right kidney, normal in shape, size, and function existed, the wound was packed with gauze and a stitch passed through the skin over the packing. The patient was placed on the left side, and an exploratory incision over the right kidney was made in the following manner:

The usual incision, three or four inches long, was made from the erector spinæ outward and downward through the skin, abdominal muscles, quadratus lumborum, and fascia. The right kidney was palpated, and found to be normal in shape and size. Its posterior lower border presented a normal appearance. A drain was therefore inserted, and the wound closed.

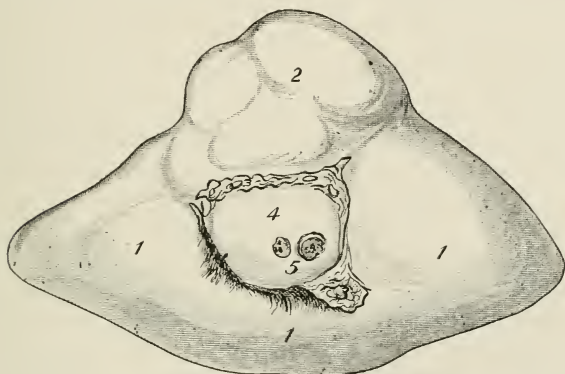
The patient was again turned on the right side, the wound reopened, and the gauze packing removed. The adipose tissue of the wound was adherent to the surface of the tumor, and was left in connection with the latter to be removed with the kidney. An elastic ligature was placed around the hilus of the kidney,—that is, around the ureter and vessels. A circular incision was then made through the pelvis and the kidney lifted out of the wound.

A permanent, heavy silk ligature was now passed by transfixion on the proximal side of the elastic ligature and the stump cut down to this point, the visible vessels being ligated separately.

The wound was irrigated and a heavy drain, half an inch in

diameter and eight inches long, was passed down to the bottom of the wound, along which a smaller unperforated tube was passed. The wound was packed with boiled carbolized gauze, united by sutures, and the usual dressing applied.

The specimen, as seen in the figure, shows the kidney to be five inches long and two inches wide. On the middle of the anterior surface is seen a smooth, globular tumor, two inches in diameter, covered with the fibrous capsule of the kidney. It is bluish red in color, and has large vessels on the surface. From the cavity of the pelvis protrudes a small, round, smooth tumor,



Left kidney seen from the hilus. 1, kidney; 2, tumor; 3, wall of pelvis; 4, portion of tumor protruding into the pelvis; 5, ulcer or abrasion on top of pelvic portion of tumor.

one and a half inches in diameter at the base, and one inch high, and rounded at the apex. At this point there is a place two millimetres in diameter, not covered by the mucous membrane of the pelvis, which forms a round island of naked tumor tissue, and which was the probable source of the hæmorrhage. There is no carcinoma in the wall of the pelvis, nor in the loose connective tissue around the large vessels.

Microscopic examination reveals a tubular carcinoma, with cuboid and cylindrical cells; no capsule surrounds the tumor, but

the kidney tissue is partly infiltrated and partly pushed aside. There is a reasonable degree of limitation.

After Treatment.—The patient remained in the hospital for eleven and a half weeks. The fistula remained open until April, 1891, discharging first a little pus, and later on slimy water.. The patient never had pain or hæmaturia. In 1892 he had a little pain in the cicatrix, for which a linseed poultice was prescribed, and an incision made later on. A small amount of pus escaped, and the abscess soon closed. Thereafter the patient had no pain, weakness, or emaciation. He was well nourished and had a good color. A cicatrix marked the incisions on the left and right side.

I examined the patient in June, 1892, and could find neither hardness, enlarged glands, pain, nor tenderness. The patient had gained thirteen and a half pounds since the operation, was married, and has one child. Urinates three or four times a day, but is not obliged to get up at night.

On April 9, 1898, the patient was seen by my assistant, Dr. Buford. He now weighs 130 pounds, works every day, eats, sleeps, and feels well, with temperature and pulse normal. He has had no disturbances in the region of the kidney since the operation. There is no pain in the region of the cicatrix, nor can any tumor be felt in either kidney. The urine is normal in amount, and urinalysis discloses no abnormalities. When he sits on the bench for a long time, he sometimes has a tired, aching sensation in and just beneath the site of the old cicatrix, but this feeling is relieved by rest.

Remarks.—The carcinoma in this case was limited to the kidney and protruded into the pelvis. There was necrosis of the pelvic mucosa at the apex of the tumor, which did not fill up the entire pelvis, thus permitting the passage of blood down into the bladder. When a tumor becomes enlarged so as to fill the entire pelvis, hæmorrhage ceases, as blood cannot pass down into the ureter. It is thus evident that hæmorrhage is likely to occur only in the beginning of malignant tumors of the kidney. It is impor-

tant to operate during hæmorrhage in the early stages, before the tumor can be felt in the region of the kidney.

In my remarks on "Diagnosis and Treatment of Carcinoma of the Kidney" (*op. cit.* p. 157) I made the following statement:

"*Remark IV.*—Lumbar exploratory incision for the exploration of the other kidney, I consider preferable to abdominal incision (by an error of the printer, nephrectomy was inserted in place of incision), which has been advocated in cases of this kind. While the latter operation permits satisfactory palpation of the kidney and ureter, I consider lumbar incision, as practised in Case II, less grave and perfectly sufficient to obtain the necessary information."

Thorkild Rosving (monograph "Nyrens og Ureters Chirurgiske Sygdomme," p. 20, published in Copenhagen in 1895), in discussing direct palpation of the kidney for diagnostic purposes, states his preference, as I had already done in 1893, for the extra-peritoneal as compared with the transperitoneal method in selected cases, because "bilateral lumbar incision is less dangerous than a laparotomy."

In discussing malignant tumors of the kidney, he remarks: "It is true that the unilateral lumbar incision enables us to efficiently examine the one kidney only, but if it so happens that if the kidney upon which we first cut down is healthy, then we can with much less hesitation, and at the same *séance*, cut down upon the other, as has been demonstrated in a case operated upon by me" (p. 193).

It will thus be seen that other surgeons have also resorted to direct palpation through a lumbar incision. As Rosving's monograph is written in the Danish language, and has not, so far as I know, been translated, it cannot be expected that Dr. Edebohls should be familiar with its contents. We might, however, reasonably expect that he should know the literature of his own country, even that which appears in the West, before he lays claim to priority for this method.

That the Western literature is known elsewhere than in the West is shown by the fact that the case in which I made use of lumbar exploration is mentioned by at least one author in this country,—namely, by John Collins Warren, on page 697 of his work, entitled “Surgical Pathology and Therapeutics,” published in Philadelphia in 1895.

I am not aware that any operator has resorted to the examination of both kidneys by means of the lumbar incision, either previous to my operation in 1890 or to my publication of the case in 1893.

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ANNALS OF SURGERY,

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ON THE SURGICAL TREATMENT OF HÆMOR- RHAGE FROM GASTRIC ULCERS.¹

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(1) *History*.—The first surgeon to resort to operative interference in the treatment of hæmatemesis from round ulcer of the stomach was Mikulicz,¹ who in 1887 operated upon a patient in whom he had diagnosed a probable ulcer of the pylorus. Upon opening the stomach he found a stenosis of the pylorus, which he divided longitudinally. He found an ulcer which, being unable to extirpate, he cauterized. The patient died fifty hours after, without recurrence of hæmorrhage. The next operation was by Mixer,² who operated upon a case of Gannett's, in which there had been recurrent hæmatemesis for three years. He did not find the ulcer. The patient dying, the autopsy showed an ulcer of the posterior wall, with a double perforation of the pancreatico-duodenal artery. In 1889, Salzer³ operated upon a case in Billroth's clinic, in which he also failed to find the ulcer. In 1892, Doyen⁴ performed gastro-enterostomy for an ulcer of

¹ Read before the Illinois State Medical Society, May 17, 1899.

the pylorus with recovery. In 1893, Roux,⁵ of Lausanne, at the French Surgical Congress, reported two cases, in one of which he ligated the bleeding artery and then excised the ulcer, and in the other ligated the artery at the two ends of the lesser curvature without resection of the ulcer. Both recovered without recurrence of hæmorrhage. In the same year Guinard⁶ performed gastro-enterostomy for hæmorrhagic pyloric ulcer with recovery. In 1894, Küster,⁷ of Marburg, reported two cases, in which he cauterized the ulcers. In both, on account of a pyloric stenosis, he did a gastro-enterostomy, the patients recovering without further hæmorrhage. In the same year (1894) Curtis⁷ (a) performed a pyloroplastic operation through ulcer floor with recovery. In 1895, Elliott and Cutler⁸ operated upon a patient with repeated hæmorrhages by resection of the pylorus, the patient dying upon the fourth day. Hartmann,⁹ in the same year, performed a gastro-enterostomy with fatal outcome for the same condition. Hirsch,¹⁰ in 1896, found no ulcer after an exploratory gastrostomy, although there had been frequent hæmorrhages. Abbe,¹¹ in 1896, had a similar experience. In the former case the patient improved; in the latter, died. Körte,¹² in 1897, reported a case at the German Surgical Congress, in which he had used the cautery on a bleeding gastric ulcer, which could not be extirpated. The patient died eight days after operation, the autopsy revealing an ulceration of the splenic artery. At the same time Mikulicz¹³ reported two cases, which he had operated in 1894, in one of which he resected the ulcer with no recurrence of hæmorrhages for three years. In a second, in which he cauterized the ulcer, the patient died the same evening. In 1897, Michaux¹⁴ operated after four severe hæmorrhages during the preceding week. He could not find the ulcer. The hæmorrhage recurred and the patient died. At the autopsy an ulcer the size of a two franc piece was found involving only the mucosa, near the lesser curvature, with ulceration of an arteriole. Cazin¹⁵ reports, in 1897, a case in which four erosions were found. He sutured them with catgut. The pa-

tient recovered without further hæmorrhages. Tuffier¹⁶ in the same year performed a gastro-enterostomy for an ulcer near the pylorus, with hæmorrhages, the patient recovering. In 1898, E. W. Andrews operated two cases of gastric ulcer with recurrent hæmatemesis, which will be the subject of this paper. At the last German Surgical Congress, held in April, 1899, König, Jr.,¹⁷ of Berlin, reports a case of resection of the stomach for gastric ulcer with continued hæmatemesis. The ulcer was situated near the pylorus, but the operator only removed the source. The resulting cicatrix caused obstruction, and a secondary gastro-intestinal anastomosis was necessary.

(2) *Clinical Forms of Hæmorrhage*.—Clinically we have three forms of hæmorrhage from gastric ulcers. (1) Foudroyant, in which death occurs in a few minutes. (2) Acute, in which there may be recurrent hæmorrhages varying from 500 to 1000 grammes. The syncope which follows causes decreased cardiac action, decrease of blood-pressure, and spontaneous cessation of hæmorrhage. (3) Chronic form, in which there are small, frequently recurring hæmorrhages, often associated with pyloric stenosis.

(3) *Source of Fatal Hæmorrhage*.—This is usually from an artery, although in four cases, described by Savariaud,¹⁶ a venous hæmorrhage was the cause of death. In considering arterial sources, they may be either from the stomach walls, which is the more frequent, or from one of the vessels adjacent to the viscus. In forty-seven cases the source was the splenic in seventeen, the coronary in six, and arterioles in ten. Other vessels, such as the aorta and even the heart, may be perforated. (See table below.) There is usually an oval perforation of the side of the vessel, but the latter may be eaten straight across. At times, when the source of hæmorrhage cannot be found, it may have been capillary.

(4) *Duration of Hæmorrhage*.—This means the time between its occurrence and its ending in either syncope or death. We may divide them into sudden death, rapid death, and death following after a longer or shorter interval, as

shown in the table compiled by Savariaud, who in his thesis, published last year, has written the most elaborate and thorough article on this subject.

Vessels.	Number.	Immediate Death.	Rapid Death.	Death after longer time.
Heart	4	1	1	2 (3 days)
Aorta	2	1	1	1 (10 days)
Hepatic	2	1	1	1 (10 days)
Splenic	17	3	7	7 (2 to 18 days)
Coronary	6	1	3	2
Pancreatico-duodenal	6	1	3	2 (8 to 15 days)
Arterioles	10	1	1	8 (4 to 15 days)
Little veins	4	1	1	2 (7 to 11 days)
Invisible vessels . . .	3	2	1	1 (21 days)

Sudden death may be the result of microscopic ulcerations, and at times there seems to be no relation between the calibre of the blood-vessel and amount of hæmorrhage, hence it is frequently difficult to estimate the size of the blood-vessel from the quantity of blood.

(5) *Varieties of Ulcers*.—The most frequent is the so-called ulcer of Cruveilhier, or simple ulcer, which may be met with in three stages,—recent, cicatrizing, or beginning. As regards size, there are also three kinds,—large, size of dollar; medium, size of quarter; and small, size of dime. These generally ulcerate down to blood-vessels of submucosa. They are met most frequently on the lesser curvature, according to Welch, and especially on the posterior wall, as the following table shows:

WELCH'S TABLE OF LOCATION.

Lesser curvature	288 (36.3 per cent.)
Posterior wall	235 (29.6 per cent.)
Pylorus	95 (12 per cent.)
Anterior wall	69 (9.7 per cent.)
Cardia	50 (6.3 per cent.)
Fundus	29 (3.7 per cent.)
Greater curvature	27 (3.4 per cent.)

VAN VALZAH AND NISBET'S TABLE.

Anterior wall	923
All other locations	425

Greiss and Cohn (*Dissertation aus dem pathologischen Institut in Kiel*) state that only 2 per cent. in the posterior wall perforate, and 85 per cent. in anterior wall.

They may be multiple, and when so, quite distant from each other. When these ulcers extend beyond the submucosa into the muscularis and serosa, they produce perigastric adhesion, induration of stomach walls, and may gradually perforate one of the perigastric vessels. Hæmorrhage may occur from simple erosions of the mucosa, and at times we may have very superficial ulcerations (*exulceratio simplex* of Dieulafoy). About twelve of these have been observed. These affect the arterioles of the submucosa, and may at times cause a fatal hæmorrhage. They are so superficial that, at times, it is necessary to use a lens to see them.

(6) *Clinical History*.—The patients may be divided into three classes: (1) Those who have had characteristic symptoms,—*e.g.*, pain, vomiting, hæmorrhages, and emaciation. (2) In addition to these symptoms, those of pyloric stenosis. (3) Those in whom the ulcers have been latent (this constitutes the history in one out of five cases). In these there are no previous attacks of gastralgia, etc., but suddenly, patients who have previously enjoyed good health, have a violent hæmatemesis.

(7) *Diagnosis*.—This can be made from the previous history of pain in epigastrium increased by food. A history of vomiting and of previous hæmorrhage is given in some cases, but in others, when a previously healthy person has a sudden hæmorrhage, the diagnosis is puzzling. A differentiation must then be made from rupture of aneurism into stomach, of œsophageal varices (frequent in hepatic cirrhosis), also from perforation of hepatic artery and portal vein by biliary calculi and from miliary aneurisms of stomach, as well as hæmoptysis, nasal hæmorrhage, and that caused by carcinoma and by syphilitic and tubercular ulcers of the stomach. The diagnosis of the seat of the ulcer from the location of the pain is not to be relied upon. We can only differentiate the hæmorrhage caused by ulcer from that due to hæmorrhagic erosions

or ulcerative gastritis by the rarity of the latter. It is also impossible to diagnose the size of the eroded vessel from the quantity of blood lost at a single time. A small arteriole can gradually cause as much loss as an ulceration of the splenic.

(8) *Mortality from Hæmorrhage*.—The average number of deaths due to hæmorrhage is five in a hundred cases of gastric ulcer. Some authors have a smaller percentage,—e.g., Leube,¹⁹ only 1.1 per cent.; Müller,¹⁹ in 127 ulcers, noted hæmorrhage thirty-seven times, of whom fourteen died, or 11 per cent., so that the maximum is the latter (11 per cent.), the minimum the former (Leube's) 1.1 per cent.

(9) *Indications for Surgical Interference*.—Gastrorrhagia belongs to the surgical domain, after medical treatment has been given a fair trial. The indications for operations on gastric ulcers, laid down by Leube¹⁹ at the German Surgical Congress, 1897, are (1) moderate recurrent bleeding (single profuse hæmorrhage not an indication); (2) severe pain and obstinate vomiting resisting medical treatment; (3) perforation.

Kocher,²⁰ in a very recent paper, confirms Leube's statements, and adds that it is well to interfere before the patient is exhausted by repeated hæmorrhages or excessive gastric trouble. He considers surgical interference "a refuge, but not a last refuge." Kocher advocates excision for hæmorrhage; gastro-enterostomy or pyloroplasty for inaccessible ulcers of those of great dimensions; suture methods rather than mechanical devices, such as plates or buttons, are his preference.

According to Dieulafoy, if a patient vomits 50 to 200 cubic centimetres of blood, he will recover spontaneously; but if one-half litre or more is vomited, especially if this be repeated once or twice, such a patient will die if not helped by operation.

These cases show that an important vessel has been opened, probably parietally, so as to be unfavorable for spontaneous closure. It is difficult to estimate the quantity of blood lost accurately, as some may have passed into the bowels.

These conclusions fairly represent the attitude of conservative surgeons, and show a growing tendency to make the disease a surgical one. As a majority of the fatal results have been from shock and exhaustion, it is certain that early interference will reduce the mortality. While it is true that the manipulations in exploring and operating upon the inner wall of a hollow viscus present formidable difficulties, we feel warranted in claiming that, with fair dexterity and a carefully elaborated technique, bleeding ulcers may be searched for, found, and extirpated with comparatively little danger.

The shock element in gastric surgery is less important than has been assumed by some writers. Thus the supposition, by Willoughby Furness,¹⁷ that the proximity of the solar plexus to the posterior wall causes sudden "heart-failure" is an hypothesis rather than a pathological fact. We find in actual practice that the impression made upon the sympathetic system is less profound in stomach operations than in the intestine. This may be explained partly by the fact that the stomach is easily located, and promiscuous handling of viscera is avoided, and partly by the fact that its walls are thicker, stronger, and less liable to be injured by palpation, the use of hooks, clamps, etc., than the bowel wall. Nevertheless, certain obstacles to success must be considered as constant. Among these are (1) previous state of exhaustion; (2) difficulty of finding the ulcer, as when it is in the cardiac end or in the duodenum, or is very small; (3) location of the ulcer on posterior wall with strong adhesions to pancreas; (4) erosion of vessels not connected to stomach wall, such as splenic artery, vena porta, hepatic artery, etc. These various difficulties will be considered in detail.

(10) *Methods of Operating*.—As to the best manner of dealing with the ulcer itself or its bleeding vessel, it may be said that excision is ideal, but is far from being practicable in all cases. In the anterior and posterior wall, and greater and lesser curvatures, it is easy except when adhesions, as to the pancreas, prevent access. Near the pylorus it is practicable with gastro-enterostomy or without it. Pyloroplasty

may be done through the floor of a bleeding ulcer. At the cardiac end of the stomach it is difficult or impossible to gain proper access for performing an excision properly.

Cauterizing the ulcer, as practised by Küster,¹⁸ seems to have been successful in several cases. No reliance is to be placed upon the cautery in checking hæmorrhage from very large vessels, such as the splenic, coronary, etc.

Proximal ligation of a large trunk may be considered more scientific. Roux in two cases successfully ligated the arteries of the lesser curvature. Savariaud advises, on theoretical grounds, ligation of vessels of both lesser and greater curvature in cases where the ulcer cannot be found. We consider the danger of possible gangrene of a segment of stomach wall great, as suggested by the frequent occurrence of this accident in the intestines. In the latter great care has to be used not to injure the afferent branches. In the thicker stomach wall the danger of sloughing from anæmia may be less, but we do not know that it is altogether absent.

Another suggestion by this writer is that the ulcer be curetted (curettage), with the expectation that the vessel or vessels will then bleed, when they may be caught up and ligated. Should the scraping process perforate the stomach wall, the conditions are favorable for closing the opening.

Ligation of the small areas of eroded mucous membrane has been practised by Cazin.¹⁴ Catgut ligatures were thrown around several bleeding points and recovery followed.

Finally, we desire to call attention to a method employed in two cases with success, consisting of the ligation *en masse* of the stomach wall drawn up into a cone including all its coats. This was done, in the first instance, because of adhesions to the pancreas preventing easy access to the posterior wall, and in the second case rather from choice, there being two separate ulcers to remove. Immediately on returning the first patient to bed an anxiety was felt lest rapid digestion by the stomach secretions should remove the mass beyond the ligation before firm closure of the vessels.

A series of experiments on living animals was then made

to test the durability of the ligature and stump, a description of which will be found below.

(11) *Technique of Operations for Hæmorrhage.*—Lavage of the stomach, favorably spoken of by some writers, should be avoided, as it may provoke new hæmorrhage. The previous light diet of the patient will insure a collapsed condition of the viscus. The horizontal rather than the Trendelenburg position should be chosen, although it is true that, in

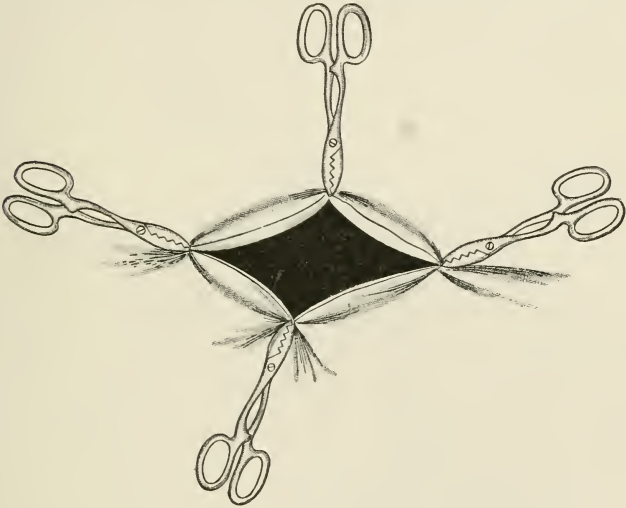


FIG. 1.—Showing incision in anterior wall of stomach, held open by forceps.

the latter, the liver requires less retraction in certain cases. Savariaud advises a bending of the trunk by pillows placed beneath the hips and shoulders to relax the anterior abdominal wall. As the location of the ulcer is usually unknown, the abdomen should be opened in the linea alba, and in a majority of cases this should be of ample length, reaching to the umbilicus. Lateral incisions can be used if special circumstances demand them. Adhesions from plastic peritonitis may cause delay in uncovering the stomach wall. These should be divided with great care and especial attention

given to hæmostasis. The stomach is easily distinguished from the transverse colon by its peculiar arrangement of vessels. Its anterior wall should be seized and, so far as possible, drawn into the abdominal wound, and held by compress-sponges in such a manner as to wall off the general peritoneum. Inspection and palpation of the external surface should now be made in a systematic manner, in order, if possible, to determine the location of the ulcer from without.

Keen²¹ states that the peritoneal coat is sometimes marked by an indurated and discolored spot opposite the

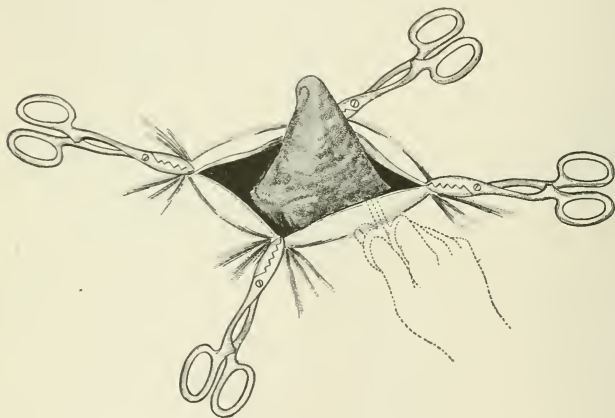


FIG. 2.—Shows hand or forceps pushing portion of stomach with ulcer into wound.

ulcer. Other observers speak of finding opposite the site of the ulcer cicatricial thickening with the peritoneum drawn into radiating folds. Such guides would be of great value to the operator as the time saved in exploring the interior would be considerable, and, probably, one incision would suffice for the excision and exploration. It is not to be assumed, however, that this exploration should be omitted even when an ulcer is found anteriorly. On the contrary, a considerable number of cases present two ulcers symmetrically located on anterior and posterior walls. Thus R. Steele²²

reports an unsuccessful case of gastrostomy in which the autopsy showed that a second ulcer in the posterior wall had been overlooked.

This condition of double ulcer is stated by Furner to be present in 13 per cent. of cases. The posterior one, being usually adherent to pancreas and tending to perforate and cause hæmorrhage, is the more important. The posterior wall should now be examined from without by the hand

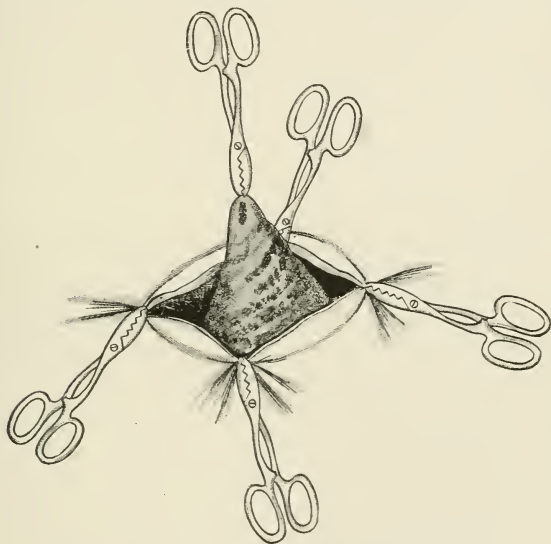


FIG. 3.—Pulling up wall of stomach with ulcer prior to ligation.

passed through an opening made in the greater omentum. (See Fig. 2.) This position of the hand, also, is advised as an aid to the internal inspection later on. In palpating the pylorus it is to be remembered that inflammatory or cicatricial thickening may cause a sensation not unlike that of carcinoma. The normal ring-like feeling of the duodenum should also be familiar to the operator. If no external guide to the location of the ulcer is found by inspection or pal-

pation, the organ must be laid open by a vertical incision six to twelve centimetres long between the branches of the coronary artery. Savariaud¹⁶ advises that these vessels be ignored, and that a horizontal incision be made eight centimetres in length, midway between the greater and lesser curvatures. Doubtless the vessels in this case could be seen and ligated easily before division, as they always lie pulsating in plain view just beneath the peritoneum. This writer's conclusions are based upon cadaver experiments, while our own rest upon experience with the living human subject and animal experiments. We cannot but think that he underestimates the difficulties and delays due to hæmorrhage which would arise from long horizontal incisions. It is certain, however, that the horizontal incision is the more favorable for examining the two ends of the viscus from within, especially the pyloric end.

Before opening the stomach, if it is much distended with gas or fluid, the surplus may be drawn off by a tube and trocar. After opening, the toilet of the interior should be continued by careful sponging with absorbent pledgets, care being taken that none of these are allowed to infect the laparotomy sponges. It is safer to have a specified number of small tampons set aside for this purpose, of such shape that they cannot be mistaken for ordinary sponges. These can be accounted for separately after the operation. The large sponges placed exterior to the stomach must not be removed until the incision in its anterior wall has been closed. The opening in the greater omentum for gaining access to the posterior wall must therefore be left so as to be accessible without disturbing them. The more the whole organ can be drawn outside the abdominal wall the safer the operation becomes, as the danger from handling and contact with the one is much less than that from infecting other viscera by contact with the mucous lining. In practice a large portion of the anterior wall can usually be brought outside, so that by careful use of pads the operation becomes for the time almost extraperitoneal. In case of numerous adhesions this

is not easily done, and the abdominal incision may have to be correspondingly larger. The search for the ulcer must now be carried on systematically by inspection of the mucous lining, assisted by palpation. Strong light is essential, and the aid of a small electric lamp and reflector is advisable. Dieulafoy advises the use of a lens.

In our first operation the stomach was explored by drawing up successive portions of the mucous surface with forceps, inspecting them through the anterior incision, and

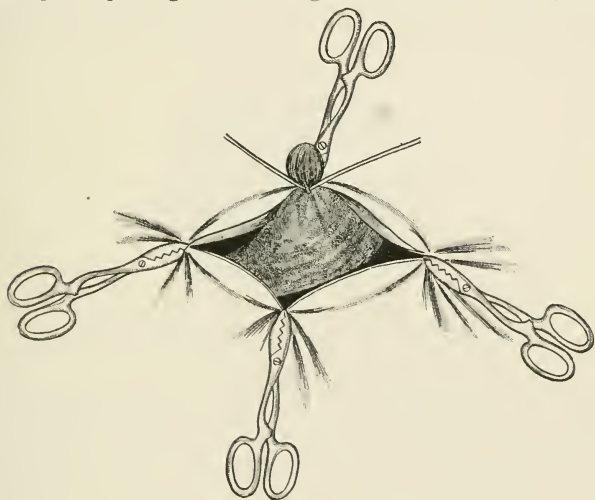


FIG. 4.—Ligating cone, with ulcer at apex.

then allowing them to return. In this way an ulcer was found located on the posterior wall. This method has the disadvantage of leaving small lacerations where the volsella have grasped the mucous membrane, which bleeds slightly, and may be mistaken for ulcers. The membrane tears very easily into ribbons if the forceps slip. With the exception of the pylorus, the lining of the stomach is best examined without being touched by instruments. The pylorus, or even a small portion of the duodenum, may be invaginated and

drawn up with forceps thrust under it. The examination of the duodenum by palpation alone is not infallible, as recent ulcers do not produce much induration. Passing from the pylorus towards the right, nearly the whole interior of the stomach may now be inspected by the following manœuvre: The hand is passed behind the organ through the opening in the omentum already mentioned. The posterior wall is now pushed forward into the opening and passed portion by portion into plain view. This may be continued until the whole posterior wall to the cardiac end has been gone over. The greater and lesser curvatures and the remainder of the

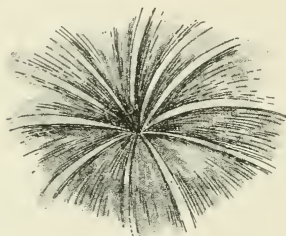


FIG. 5.—Depression on peritoneal surface caused by pushing stomach wall into lumen to ligate it with ulcer.

anterior wall may in the same manner be caused to invert and pass in review beneath the opening, the latter being caused by traction to assume various positions to assist in this invagination. Should the posterior wall be adherent to the pancreas, as in Case I, and somewhat immovable, that particular part of the viscus should be inspected by reflected light. In such a case the lesser peritoneum should be opened, which will give additional access to the posterior wall.

We now come to a portion of the stomach interior which cannot be drawn down or forward,—namely, the cardiac end,—where it is covered by the left lobe of the liver and attached to the diaphragm. To inspect these parts it is necessary to illuminate the cavity and retract the liver and costal arch. The Trendelenburg position would probably be of assistance

at this stage, both in gaining access and in the matter of illumination. With care a good view can be obtained of the whole cardiac end and opening.

The search for ulcers should be prosecuted systematically, and in our opinion should be in the following order:

(1) Anterior and posterior walls, and greater and lesser curvatures.

(2) Pylorus and duodenum.

(3) Cardiac end.

This is based on the order of frequency, as shown by the statistics of Welch, quoted above.

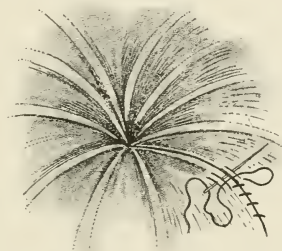


FIG. 6.—Lembert sutures closing depression and reinforcing deligated area.

It is obvious as but 12 per cent. are at the pylorus, and 6 per cent. at the cardiac end, that the two ends may be examined last. We may even omit the examination of the stomach orifices after having found one ulcer in the middle portion without great risk of overlooking a second. We advise, however, that the pylorus be not passed by except where the time element is very important, since pyloric ulcers and their sequelæ in the form of stenosis are not uncommon.

In our second case a stenosis of the pylorus probably existed at the time of the first operation. It could have been remedied by a pyloroplasty with slight additional risk.

Before speaking of the actual treatment of the ulcer it may be well to consider the problem presented by the failure to find any ulcer or source of hæmorrhage. The ulcer may

be concealed beyond the pylorus in the duodenum, in such a case gastro-enterostomy or pyloroplasty may be unavoidable. The invagination of the duodenum is practicable for a distance of four or five centimetres,, within which distance, according to Colin, 92 per cent. of duodenal ulcers are found. The Loreta operation of digital divulsion of the stenosed or normal pylorus is to be advised as an aid to exploration.

(12) TREATMENT OF THE ULCER WHEN FOUND.

Excision.—The ideal treatment of the ulcer when found is unquestionably excision. The afferent vessels are in this method divided, and can be secured before the sutures are applied. In the central portions of the stomach, where both mucous and peritoneal surfaces are accessible, an elliptical piece of the wall including the ulcer can be removed, and the wound closed by double or triple lines of suture with the utmost security. It is doubtful whether excision from the mucous side alone without access to the outer wall, so as to place a Lembert suture, is safe against leakage. When the posterior wall is adherent to the pancreas and the ulcer has penetrated its substance, it may be assumed that the bleeding vessel is the splenic artery. When at the pylorus, it is the pancreatico-duodenal. In the cardiac end the ulcer is also inaccessible except from the mucous surface.

Cautery.—In all these locations we may resort to the Küster method of actual cautery. The smallest Paquelin point is well shaped for this purpose. Küster adds gastro-enterostomy to the cauterization with a view to removing the cause of the disease. The cautery has the merit of prompt and positive closure of small vessels, but is not to be depended upon for sealing large arteries, such as the coronaries or splenic. The exact state of the ulcer after separation of the slough, whether it shows a tendency to better healing, is not known. The possibility that the cautery might lead to perforation in an ulcer already deep, ought seriously to be considered. This seems to us a real danger. Should the eschar involve the whole thickness of the stomach

wall, peritoneal adhesions would form rapidly around it which, before the time of separation, might prevent leakage.

Curetting.—Ulcers situated unfavorably for excision may be denuded with a curette. Should this reopen a bleeding point, the conditions are favorable for the application of forceps and ligature. The hæmorrhage thus started might, however, be difficult to check if the tissues were friable, or if it came from a deep source, such as a perforation in the pancreas.

Ligature of Mucous Membrane.—Dieulafoy and Colin have advocated, in what is termed by the former “*exulceratio simplex*,” causing superficial erosion, that the bleeding spots be tied up in loops with their underlying mucosa.

Ligature en Masse of all Coats of the Stomach from Within.—This method was used tentatively in Dr. Andrews’s first operation, and more or less deliberately in Case II. Dr. Eisendrath then suggested that the value of the method be tested by animal experiments, and a number of these operations were performed to settle the question of the durability of the ligated mass, the danger of perforation, rapidity of healing, and most advantageous technique. These will be spoken of shortly.

(13) OPERATIONS ON THE HUMAN SUBJECT.

CASE I.—Mrs. F. H., aged thirty-eight years. Family history negative. Had borne nine children, seven living. Has had six miscarriages without serious consequences. Never has been ill otherwise. Present trouble existed two years. Has had constant boring pain located beneath xiphoid cartilage, greatly increased, at times, by ingestion of solid food; Appetite poor. For the preceding two months has been able to use only liquid food.

May 28, 1898, Dr. W. W. McCleary was called to see the patient, who was in collapse from sudden profuse gastric hæmorrhage. This amounted to a litre (estimated) of dark blood, and patient became unconscious for a few moments. A sensation described as gurgling was felt at the time. The following day another profuse hæmorrhage occurred, producing faintness and prostration, but no loss of consciousness. Dr. E. Wyllys An-

drews, in consultation with Dr. McCleary, advised immediate removal to the Michael Reese Hospital, where patient was taken same day for operation. The condition was then one of extreme prostration from anæmia, with characteristic pallor, weak pulse, and cold, relaxed skin.

Operation.—Gastrotomy, by Dr. Andrews, assisted by Dr. McCleary and Dr. Schram, May 30, 1898. Abdomen incised from xiphoid cartilage to umbilicus. Parietal peritoneum anchored to skin by temporary sutures. The anterior wall of the stomach was then drawn into the field, isolated by sponges, and incised vertically eight or ten centimetres. Bleeding vessels in the stomach wall were secured. Stomach explored by inspection, the greater and lesser curvatures and posterior wall being drawn up with forceps, and examined step by step until the ulcer was found opposite the opening on the posterior wall. This was round, twelve millimetres in diameter, and deeply eroded. Its floor was formed by grayish necrotic tissue. Probably this was gland tissue of the pancreas, to which the stomach wall seemed adherent. The posterior wall could not be drawn up freely, but was lifted somewhat, and the question of excision decided in the negative. This decision was based upon the idea that a suture placed from within could not be made secure against leakage. It was thought that the extravasation, even if not into the free peritoneum, would be as disastrous in the end from burrowing and sepsis. The ulcer was drawn forcibly forward, so as to form the apex of a cone around the base, of which a strong ligature was tied as in Figure 4. Just what tissues this included could not be ascertained, but certainly all the coats of the stomach. The anterior wall was then closed by Czerny-Lembert suture, and the laparotomy finished in the usual way.

This patient made a rapid recovery, and has remained well, as reported by Dr. McCleary, up to the present time.

CASE II.—C. L., male, aged thirty-six years. Patient had suffered for several years from cardialgia and nausea. Dr. A. H. Wales, who saw him July 5, 1898, made a diagnosis of gastric ulcer, and referred him to Dr. Frank S. Johnson. The day preceding he had a profuse gastric hæmorrhage. He was put upon nutritive enemata containing spirits frumenti and eggs and milk peptonized. This treatment, with occasionally milk and lime-water by the stomach, was continued about two months. Gastric

pain was a constant symptom during the summer, and emesis was rather frequent. September 16, the stomach was washed out after a test-breakfast. Laboratory report showed a large amount of mucus, free hydrochloric acid, and no organic acids. A second washing, September 18, was identical.

September 22: Patient still complained of gastric pain, and at 5 P.M., after injecting a small amount of milk, had a severe hæmorrhage, about 800 to 1000 cubic centimetres of nearly fresh blood. Dr. Johnson referred the case to Dr. Andrews, who performed gastrotomy April 26, with the assistance of Dr. Eisen-drath and Dr. McCleary. The abdomen was incised from sternum nearly to umbilicus. No adhesions found. Anterior wall drawn forward, isolated by sponges, and incised vertically at middle, eight centimetres. Systematic exploration revealed one considerable erosion on posterior wall, size one centimetre. This scarcely penetrated below the mucous membrane, and bled on handling, but not profusely. Similar but smaller erosions were found at three other points, one posterior, and two on anterior wall. These caused no perceptible thickening on peritoneal side. All these points were ligated off with large silk, and the stomach wall united as in Case I.

This patient was thoroughly exsanguinated before the operation, but suffered no unusual prostration as a result of it. Saline solution was used by rectum only, and rectal feeding continued for two weeks, when small amounts of milk were given. He continued to suffer from gastralgia until he left the hospital, November 3, 1898.

Blood examination the day of operation, September 26, showed red corpuscles, 900,000,—hæmoglobin 18 per cent. September 29, showed red corpuscles, 1,200,000,—hæmoglobin, 24 per cent. October 3, red corpuscles, 1,400,000,—hæmoglobin 28 per cent.

Patient passed later to the care of Dr. Otto Schmidt at Alexian Hospital, who reported no further hæmorrhages. He continued, however, to suffer from gastralgia and dilated stomach, which resisted all treatment. February, 1899, he underwent an operation for gastro-enterorrhaphy by the button. This was performed by Dr. E. H. Lee, of the surgical staff, Dr. Andrews being present and examining the pylorus, which seemed contracted by internal cicatrices. Patient did well for one week, but

died at the end of that time in collapse from general peritonitis. The autopsy showed failure of union at the point of approximation, causing leakage of stomach or bowel contents.

(14) EXPERIMENTS ON DOGS.

In order to confirm the value of this method experimentally, the operation, as it had been performed upon two human beings, was repeated upon nine dogs. The technique of the operation was alike in all. An incision was made in the median line after the usual disinfection of the abdomen; the peritoneal cavity opened and stomach pulled out. An incision about eight centimetres in length was made in the anterior wall, about midway between the greater and lesser curvature, and an equal distance from cardia and pylorus. In those dogs in which two areas were ligated, two portions of mucous membrane were snipped off with a scissors, to resemble in some degree an ulcer as it occurs in the human subject. This was merely from an anatomical stand-point, in order to test the value of the method for ulcers situated at different parts of the stomach, it being impossible to imitate the exact pathological conditions found in the human subject. After ligating such an area, as shown in the drawings, which was done by pushing up such a hypothetical ulcerated surface, with the finger inserted on the serous surface, strong silk was used as the ligature material, the deligated cone, which included all of the coats of the stomach, rapidly became of a dark blackish color and sharply demarcated from the surrounding mucosa. On the serous surface, as shown in Figs. 5 and 6, a distinct depression was visible, corresponding to the area which had been invaginated. This puckered-up, depressed area was closed by serous sutures. Our reason for having the latter as part of our uniform method will be shown later. After varying intervals of time the dogs were killed.

The first dog operated upon was killed one and a half days after the operation. The deligated areas were readily found on

the anterior and posterior walls, one place in each having been selected at the time of the operation. The serous sutures were covered by a perfect plastic lymph. There were no evidences of peritonitis. Examination of the deligated areas themselves, after opening the stomach, showed that no digestion of the same had taken place. There was a sharp demarcation between the invaginated portion, at the summit of which was an ulcer, and the surrounding mucous membrane. Sections examined microscopically showed that the ligated portion no longer took the stain and that there had been some hæmorrhage into the various tunics of the stomach which had been thus cut off from their nutrition. Near the ligature the vessels of the submucosa were thrombosed, and the tissues around it again took the stain. The second dog was killed after three days. In this the condition was about the same, only that the invaginated portion was softer. In a dog, killed four days after operation, in place of the deligated areas, there were ulcers in the mucous membrane about the size of a quarter, with rather sharp edges, and the floor covered with mucus and stomach contents. On section of the stomach wall this floor was seen to be formed by the muscularis and serosa. Microscopically these ulcers resembled completely recent ulcers as found in the human stomach. The upper layers of the muscularis and of the remaining submucosa were densely infiltrated with round cells. The blood-vessels were filled with thrombi. We thus see that it requires about three and a half days to digest such a ligated area in the dog's stomach.

A fourth dog was killed eleven days after operation. The condition found, on examination of the interior of the stomach, was about the same as in the fourth-day dog, but differed microscopically in the fact that the round cells were being replaced by granulation tissue and the thrombi beginning to be organized. In both of the latter dogs there was considerable thickening of the peritoneum, but no adhesions to the surrounding viscera. In the eighteen-day dog—that is, one which was killed eighteen days after operation—the ulcers could be distinctly seen. The walls of the stomach which formed the floor were thicker than the surrounding portions, and on microscopical examination it was evident that cicatrization of the ulcer was beginning. The edges were firm and contracted. Externally, there was no evi-

dence of any puckering in of the serosa, simply a line of organizing plastic lymph covering the Lembert sutures.

The seventh dog, killed thirty days after operation, showed both on the anterior and posterior walls internally, corresponding to the deligated areas, ulcerations of the same characters as those just described resembling the ulcers seen clinically in the human being. A loop of the Lembert suture presented in the bottom of one of the ulcers; the serosa on the external surface was continuous in both. The edges of the ulcer were also firmly contracted, and there was evident thickening of the stomach wall over the ulcer.

None of the above dogs showed any signs of peritonitis, nor had any hæmorrhage, showing that the thrombosis beneath the deligated areas had been sufficient to prevent any hæmorrhage.

In all of the dogs thus far spoken of the method of picking up and tying off the entire thickness of the stomach wall, about half an inch from the edge of the ulcer, and reinforcing or supporting this with a row of Lembert sutures on the serous side, was uniformly used. Between the third and fourth dog, two dogs were operated upon, both of which showed the necessity of using these reinforcing sutures. In one dog death occurred on the fourth day after operation, from a perforative peritonitis, the gastric juice having apparently digested off the ligated area, and caused a perforation in the stomach wall corresponding in size to this area, with a resulting perforative peritonitis.

In a second dog, also operated upon without reinforcing serous (Lembert) sutures, the animal was killed upon the fourth day, and it was found that a perforation similar to the one just described was beginning, and unquestionably would have caused death within a short time.

We found in dogs (1) that every portion of the stomach could be easily inspected and operated according to the method employed in two clinical cases.

(2) That between three and four days were required for the gastric juice (which contains a larger percentage of

hydrochloric acid than the human) to digest completely the cone of ligated stomach wall including the ulcer.

(3) That, unless reinforcing or supporting sutures were used on the serous surface, digestion and perforation of all of the coats would take place too rapidly, and a perforating ulcer result. In both of the cases operated upon in the human being these latter sutures were not employed, but shall be wherever possible in future.

CONCLUSIONS.

(1) The result of the practice of the best modern surgeons warrants the statements previously made, on theoretical grounds, that only operative interference can save the lives of a part of the patients affected with bleeding ulcers of the stomach,—viz., those not improved by internal medicine.

(2) Surgical intervention is to be recommended, first, in small, repeated hæmorrhages; secondly, in severe ones, occurring more than once, especially if more than 500 cubic centimetres are lost at each hæmatemesis.

(3) A single copious hæmorrhage is not necessarily an indication for operation.

(4) In ulcers at or near the pylorus, pyloroplasty (Heineke-Mikulicz) is ideal. It makes local treatment possible, and gives all of the benefits of gastro-enterostomy, and is safer.

(5) Cauterization and curetting of the ulcer should give place to resection wherever the stomach wall can be reached from without.

(6) If adherent posteriorly and at ends of stomach, cauterization, curettement, and ligature *en masse* are the best substitutes for excision.

(7) Ligature *en masse* is shown, by our experiments, to endanger perforation, except when supported by external sutures.

BIBLIOGRAPHY.

¹ Archiv für klinische Chirurgie, 1888, Band xxxvii, p. 79.

² Boston Medical Journal, 1889, p. 38.

³ Archiv für klinische Chirurgie, 1889, Band xxxix, p. 833.

⁴ Traité sur la Chirurgie des Affections de l'Estomac, p. 132.

⁵ Revue de Gynécologie, 1897, p. 113.

⁶ Thèse, Trognon, Paris, 1893.

⁷ Archiv für klinische Chirurgie, 1894, Band xlviii, p. 787, and Centralblatt für Chirurgie, 1894, p. 1254.

⁷ (a) ANNALS OF SURGERY, August, 1894.

⁸ Boston Medical and Surgical Journal, 1897, p. 54.

⁹ Savariaud, Thèse de Paris, 1898.

¹⁰ Berliner klinische Wochenschrift, 1896, p. 847.

¹¹ Medical News, 1896, p. 284.

¹² Proceedings of the German Surgical Congress, 1897.

¹³ Thèse de Marion, Paris, 1897, and Proceedings of the German Surgical Congress, 1897.

¹⁴ Presse Médicale, 1898, p. 31.

¹⁵ Presse Médicale, 1899, p. 31.

¹⁶ Savariaud, Thèse de Paris, 1898, p. 128.

¹⁷ Philadelphia Medical Journal, April 29, 1899, p. 929.

¹⁸ Savariaud, Thèse de Paris, 1898, p. 128.

¹⁹ Proceedings of the German Surgical Congress, 1897.

²⁰ Correspondenzblatt für schweizer Aerzte, p. 610, 1898.

²¹ New York Medical Journal, June 11, 1898.

²² London Lancet, August 3, 1895.

ACTINOMYCOSIS IN MAN, WITH SPECIAL
REFERENCE TO THE CASES WHICH
HAVE BEEN OBSERVED IN
AMERICA.¹

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Definition.—Actinomycosis is a specific infectious disease, affecting both man and the lower animals. It is caused by an organism called the *streptothrix actinomycotica*, or what is commonly called the "ray fungus." This causes lesions somewhat like those caused by the tubercle bacillus, and for this reason it is grouped with the infective granulomata.

Geographical Distribution.—The disease has been found in about all the European countries, in Algeria, Egypt, America, Australia, and some of the islands.

History.—The disease has only been definitely known for a few years, but it was undoubtedly described by many of the early writers, who mistook it for either tuberculosis or cancer, a mistake common enough at the present day.

In France, as early as 1826, we find Leblanc describing, in the *Journal de Médecine vétérinaire*, a disease manifesting itself in cattle, the most prominent symptom of which was the swelling of the jaw. In England, Professor Dick observed the swelling of the jaws of cattle which was known as "clyers." He noted the occurrence of this as early as 1833, and in 1841 he states that the disease was known to affect human beings,

¹ Any physician having unreported cases of actinomycosis will confer a great favor by sending the notes of the cases as complete as possible to the author. Full credit will be given when they are published.

the seat of the trouble being the jaw. In 1845, Professor Simmonds spoke of it as scirrhus tongue. It was in this year also that Langenbeck described a case of vertebral caries in a young man, in which there were yellow grains in the pus. His description was brought to light in 1878 by Israel in his classical article, and there is little room to doubt that Langenbeck really saw a case of the disease. In 1850, Davaine described a tumor occurring in the jaw of an ox in which there was seen yellow grains "which, under the microscope, had neither the characters of tubercle nor of pus."

Lebert, however, published the first case of the disease occurring in man in his *Atlas d'Anatomie pathologique*, in 1858. This case was a patient of Louis, seen in 1848, suffering with an abscess with great swelling in the thoracic region. His plates and the description accompanying them are very apt.

The disease was also described by Robin and Laboulbène in 1853.

In 1863, Rivolta commenced his studies, which extended over twenty years, of the tumors of the jaw of oxen, known in Italy as the "*mal de rospo*." In 1868 he announced the discovery of the rod-shaped bodies in the pus, which he compared to the rods of the retina. He attempted inoculation experiments, which at that time failed, but which later were successful. In many later papers he established the identity of the disease in the horse, the dog, and, indeed, in most of the domesticated animals.

In Germany, a case of the disease was seen by Heller in 1872. He did not recognize it as such, however, until 1884.

The "sulphur granules" were described by Perroncito in 1875. He noted their occurrence in a case of "osteosarcoma" of the jaw of an ox.

Thus far the observers, while clearly recognizing the condition, did not appreciate its significance. It remained for Bollinger, who studied the disease about this time, to prove that the elements found in these "sarcomas of the jaws of oxen" had some causal relation to the lesion. In

1876 he gave the yellow granules to the botanist Harz, of Munich, who recognized the parasitic nature of the bodies and gave the name to it. Bollinger's article was published in 1878 and that of Harz in 1879.

In 1878, J. Israel published in *Virchow's Archives* two cases of a new form of mycosis occurring in man. He described the fungus occurring in the multiple abscesses, and made excellent drawings of the different forms.

In the following year Ponfick found the same fungus in a case of prevertebral abscess. He was the first to suggest the identity of the disease in man and animals. Following this came a period of bitter discussion between the Italians and the Germans over the priority of the various discoveries. The literature concerning this contains nothing remarkable.

It remained for John, after the unsuccessful attempts of Rivolta, Bollinger, and others, to succeed in producing the disease by inoculating the yellow granules into an ox.

Since these articles the disease has been described by many different observers in the various countries.

In former years the greatest frequency was noticed in the environs of Berlin. Then coming, in 1892, by gradual descent, Austria, Switzerland, Russia, Denmark, England, and Italy. This means merely that the medical men of these countries had learned to recognize the disease.

The first case in man in England was noted by Dr. Harley at St. Thomas's in 1884. Bristowe also had a case in the same year (*St. Thomas's Hospital Reports*, 1884, p. 243, also *Transactions of the London Pathological Society*, 1885). There are specimens in the St. Thomas's Hospital Museum labelled "*Scrofulous Disease*." These specimens have been there for thirty years at least. They were studied microscopically in 1884, and proved to be actinomycosis.

In America, as in other countries, the disease was first noted in animals. As early as 1883 the disease was remarked by many different observers throughout the country. Among these may be mentioned Dr. Belfield, of Chicago (*Medical News*, 1883, p. 569). Dr. Belfield made the claim

of being the first to recognize the disease in this country. This claim is not well founded, as Dr. Osler, together with Dr. Clement, mentions the disease as occurring in Canadian cattle, and the former demonstrated the specimens in his classes in McGill University. Dr. Law, of Cornell University, had also demonstrated it in his classes, and Dr. Taylor, of the Agricultural Department in Washington, had mentioned it as occurring in dogs.

The first cases in man were reported by Murphy, of Chicago, in 1885. These first cases were questioned by other members of the profession, and a rather bitter discussion followed. The greatest stress was laid on the fact that Murphy was not able to present the specimens, because they had spoiled, and also that certain inoculation experiments had failed to reproduce the disease. In reviewing the evidence, there is not the slightest doubt that they were genuine cases of the disease. Since that time Murphy has reported five cases altogether, and his sixth case is reported in this paper.

The majority of these cases, as will be seen in the accompanying table, are from medical centres, where the best equipped men are found.

In four of the cases the residence of the patient was not stated. New York, 17; Chicago, 14; Baltimore, 5; Boston, 2; Brooklyn, 2; Cleveland, 2; Milwaukee, 2; Cambridge, Mass., 1; Buffalo, 1; Luzerne County, Pa., 1 (reported from Philadelphia); Waterford, Va., 1 (reported from Baltimore); La Fayette, Ala., 1; Dubuque, Ia., 1; Osceola, Wis., 1; St. Paul, Minn., 1; Minnesota, 1; Denver, 1.

Sex.—Thirty-eight were males, 15 females, and 3 not stated. Other observers find the same preponderance of male cases. Poncet and Bérard found in 357 cases that 248 were males and 109 females. Leith in 405 cases gives 295 males and 110 females.

Age.—The age was not stated in seventeen cases. The youngest was six and the oldest sixty-five. The youngest case on record is in a child of one and the oldest in a man of seventy-seven years.

The ages were as follows: 6, 13, 13, 17, 18, 18, 19, 21, 21, 21, 21, 22, 27, 28, 28, 29, 30, 30, 30, 32, 32, 34, 35, 36, 37, 43, 43, 48, 50, 50, 51, 52, 53, 55, 55, 56, 60, 60, 62, 65.

By decades: From one to nine, 1; ten to nineteen, 6; twenty to twenty-nine, 9; thirty to thirty-nine, 9; forty to forty-nine, 3; fifty to fifty-nine, 8; sixty to sixty-nine, 4.

The figures of Leith are as follows: From one to five, 4; five to ten, 7; ten to fifteen, 17; fifteen to twenty, 49; twenty to twenty-five, 63; twenty-five to thirty, 60; thirty to thirty-five, 34; thirty-five to forty, 52; forty to forty-five, 28; forty-five to fifty, 26; fifty to fifty-five, 24; fifty-five to sixty, 18; sixty to sixty-five, 5; over sixty-five, 5.

Hutyra gives his compilation as follows: From five to nine, 7; ten to nineteen, 44; twenty to twenty-nine, 118; thirty to thirty-nine, 78; forty to forty-nine, 54; over fifty, 56.

From the foregoing figures it will be seen that the disease is one of young adult life, the greatest number of cases occurring in the third decade.

Habitat.—The disease is more frequent in those living in the country, and it has been stated that the disease was especially prevalent in cattle which had grazed on the salt marshes that were from time to time flooded by the sea.

Season.—Boström has stated that in cattle the majority of the cases occur in winter, and more so if it has been damp. There are no reliable statistics bearing on this point in man.

Social Condition and Occupation.—In the American cases there were 25 not stated; of the others, 6 were farmers, 3 merchants, and 3 clerks, 2 each cattle-raisers, school-girls, and laborers; 1 each machinist, steam-boat captain, butcher, soda-water manufacturer, servant, miner, laundryman, house-worker, house-wife, carpenter, stone-mason, rigger, factory hand, stableman, and physician.

Leith analyzed a hundred cases taken at random, and found that 10 were coachmen or grooms; 32 were peasants or workers in the fields (five of whom were especially mentioned as being engaged about cattle); 25 were farmers,

grieves, or land-owners, 8 bakers or millers, 17 merchants or commercial travellers, 5 students, and 3 physicians.

As might be expected, the cases are most frequent among those who live under unfavorable hygienic conditions and who do not always have the best of food. They are more liable to infection from their necessarily lowered resistance and also from their occupation bringing them in contact with the organism. They are not the only ones affected, and almost every walk of life furnishes examples of the universality of the actinomyces.

Race.—All races seem to be affected. The negro does not seem to show any especial predisposition to the disease. Cases have been reported in the negro by Hudson and Flexner and by Latimer and Welch.

Methods of Infection.—*From Cattle.*—Leith denies the possibility of the direct contagion from cattle. From what we know of the parasite, we would not expect it to be one to spread much from animal to animal, as Liebman has shown that the organism loses its virulence in passing through animals. There are cases, however, that seem to show that direct infection is possible. Ochsner's cases, which will be quoted subsequently, both illustrate this point. In the first case the patient had driven a horse affected with "lumpy jaw" for the six months previous to his illness. The second was a cattle-dealer, who frequently handled cattle affected with the disease. These he was accustomed to treat by curetting and cauterization with arsenic paste.

Infection from Man to Man.—There is but a single instance of this kind on record, and that is the case of Baracz, who reported that the disease was transmitted from a woman to man by kissing.

From Milk and Flesh used as Food.—Neither of these is very probable, as there have been no cases reported where the chain of evidence was complete. There has been considerable theoretical discussion on this point, from the stand-point of meat inspection. Meat of cattle affected with the disease is not desirable for food on general principles. Bollinger

thought that his brain case was due to milk infection, as his patient had subsisted on unboiled milk during the last year of her life. The actinomyces has never been found in milk, and rarely attacks the mammary gland in the cow.

From Grain.—This mode of infection is fully established. It may take place in two ways. First, by breathing in the infected dust from the grain during threshing, a point noted by the French observers. Second, by direct infection from the grain or plant itself. This latter was first brought out by Jensen, who reported the disease in a herd of cattle which had been fed on barley which had grown on a salt marsh.

Johne observed a sheath of barley in the tonsil of a pig which had the disease.

To Boström we owe the establishment of the fact on the finding of the remains of grain or its sheath in the lesions of eleven cases. Numerous observations of a similar nature have been made since. In many cases, where the remains have not been found, there is a history of the patients having been habitual users of straw for tooth-picks or to have eaten raw grain. Such was the case reported by Poncet, where the patient, an old woman, carried wisps of straw in her mouth to tie up vines with, and of a similar nature is the celebrated case of Leith, whose patient carried grain in his pocket to chew on at odd moments.

Incubation Period.—The incubation period varies from a week to several years. To illustrate these periods of time we may cite three cases. The first was reported by Guermontprez and Angier (*Gazette des Hôpitaux*, 1892). The patient was a man who wounded his gum with a piece of corn-stalk. Eight days later he had a hard, painless swelling appear on the site of the wound. This proved to be actinomycosis. Guillemot (*Lyon Médical*, January 26, 1896) describes a case where a man was struck with a piece of wood and a few weeks later developed the disease on the same site (Morris). The third case is that of Müller. His patient, a woman, ran a splinter in her finger, and two years later had actinomycosis develop in the

same place. A portion of the splinter was removed in the affected tissue.

Biology.—The actinomyces were classed among the moulds by Harz, and the other observers have placed it first one place and then another. We may regard its place as settled now through the labors of Cohn and subsequently of Sauvegau and Radais. Cohn placed it with the streptothrices for reasons given in the consideration of the differential diagnosis of the organism. Sauvegau and Radais agree that this is where it belongs, but give it another generic name on account of the prolific spore-formation (*oöspora bovis*). *Streptothrix actinomycotica*, the name suggested by Rossi Doria, is perhaps the best name for designating the organism.

It is to be considered from two points of view, as it occurs in tissues and as it occurs in cultures.

There are three component parts of the organism. First, the long, thread-like form, which branches dichotomously. It has no sheath and consists of continuous threads of protoplasm. As these filaments grow older there is a tendency for the protoplasm to break, and this gives the appearance of chains of streptococci enclosed in a tube (very beautifully figured in Leith's article, as are the other forms). These segments are not of the same length and the interval between them may vary considerably. In some places there is shrinking in the protoplasm and in other places there is swelling, giving rise to irregularities in the diameter.

The second form, which is very constantly present, except in very young colonies, consists of small coccus-like bodies. Leith, as the result of numerous experiments, came to the conclusion that the filaments give rise to the cocci either by terminal exclusion or lateral disruption; that these cocci grow out into the bacillary forms; that these bacillary forms become arranged end to end and form the filaments, or that they grow out uninterruptedly into filaments, and, lastly, that the clubbed ends are unnecessary to this process.

Boström's conclusions are that the coccus-like bodies

are the spores of the organism; that they grow out into short bacillary forms, and these in turn grow out into the filaments; and that the clubbed ends are to be regarded as degenerations of the filaments.

The third element consists of the clubbed ends already referred to. These are found rather constantly in the lesions in the ox, but are frequently wanting in the cases in man. They consist, as pointed out by Boström and later by Sauvageau and Radais, of degenerations of the ends of the filaments. They are, as their name would indicate, club-shaped or pear-shaped bodies, seen at the periphery of the colonies arranged radially. In some cases the filaments can be traced into the club. Boström states that in his cultures the clubs never vegetated. This has been the experience of other observers.

In the tissues the organism is usually found in abundance. It occurs in the pus as small yellowish masses or grains, varying in size from that which requires a magnifying glass to make it out to that of a pinhead (one or even two millimetres in diameter). The pus in which these are found is usually of a glairy, mucus-like nature and of a greenish-yellow tint. The color of the granules is ordinarily that of sulphur, hence the name "sulphur granules." They may be darker in color. Langhans has reported a case where the color was black. They are at times almost white, and may be of a greenish hue. They are the most important diagnostic feature.

Suspected pus is best examined by smearing it upon a piece of glass when the grains become very apparent. They crush easily, and may be teased in salt solution for examination under the microscope. Under a moderately high lens the centre of the mass appears as a tangled mass of thread-like bodies. More frequently the centre of the mass cannot be differentiated, and it is only at the edges that the nature of the grain can be made out. At the edge there are numerous tangled filaments interspersed with small, round, coccus-like bodies (spores). If one is fortunate enough to

have a specimen where there are clubbed ends, they are seen at the periphery as large pear-shaped masses. The examination is made easier by tinging the specimen with eosin or by staining with picro-carmin. For careful study there is no better method of staining than the Gram-Weigert. The clubbed ends are stained best by Mallory's method. This consists in the following:

Aniline-oil-gentian-violet, 10 minutes; iodide 1, iodide of potash 2, water 100, 5 minutes; saturated solution of fuchsin in aniline oil, 2 to 5 minutes. Decolorize in aniline oil. Wash with aniline oil and xylol, equal parts. Wash in xylol and mount in xylol balsam. During this process the section should be watched under a lower power lens.

The Erlich-Biondi method also gives very satisfactory results for sections.

In the sections the colonies vary somewhat in appearance. Some of them are radiate in their arrangement, as Leith says, "like some of the burr-like heads seen on some of the climbing plants." The central part is generally so dense that it stains almost perfectly blue by Gram's method. If there are clubbed ends present, they are arranged about the edges, and the whole then has the appearance not unlike that of looking down upon a chrysanthemum or daisy. If the sections are very thin, they will only be seen about the edges, the centres then being a tangled mass of filaments instead of the tops of the clubbed ends. The cells in the immediate neighborhood of the colony have undergone hyaline degeneration or necrosis, like the cells surrounding a mass of tubercle bacilli. Some of the colonies are larger and more oblong in shape, while others are what Leith calls the hollow-sphere colonies. They are peculiar, in the fact that the ends of a colony will grow out, forming nearly a circle with the centre of it free or nearly free from the organism. The ends when they approach each other do not always grow together, but sometimes turn outward and grow away again. In some instances the spheres are more or less perfect.

Cultures.—The organism can be grown on most of the

ordinary media used in bacteriological laboratories. There are a number of valuable papers on this subject. Among them are those of McFadyen, Boström, Israel, Sauvegau and Radais, and Van Niessen.

The cultivation of the organism is by no means as easy as some of these observers would have us believe. In many cases the streptothrix refuses to grow at all, and in others it is so badly contaminated as to be useless. In order to get pure cultures it is necessary to use all known precautions. A large number of sulphur granules should be sown in agar, gelatin, egg, or potato, and placed in the thermostat. They should be examined daily with a hand-glass and the contaminated cultures discarded. The organism is an anaërobe, and grows best with the exclusion of the air.

The growth appears in four or five days (Babes) or at a longer interval, from eight to fifteen, as in the experiments of Sauvegau and Radais, although these authors speak of a visible growth at the end of as short an interval as forty-eight hours. On solid media the growth appears as grayish-white colonies, some of which have a slight greenish tinge in them. As they grow older they increase in size and become darker in color. In some they have a yellowish appearance.

In Leith's experiments the growth was not visible with a hand-glass until the fifth day, and not with the naked eye until the seventh day. Then there were small grayish colonies present. At the end of fifteen days they had become as large as pinheads, and in three weeks they had a yellowish appearance. They increased very little in size after this.

These cultures, as Boström has pointed out, become covered with a whitish or grayish velvety layer, which has been shown to be made up of spores. Boström also mentions the visibility of the growth at the end of forty-eight hours. His cultures became red or yellow at the end of fifteen days.

In my own experience the growth was never visible before the end of a week. They were at first grayish white, and

soon became lemon-yellow in color. As they became older they grew darker in color, some of them attaining a rich orange color. They developed the velvety layer which can be exactly described by the word used by children, "fuzzy." The cultures were very adherent to the media, and when detached often brought away portions of the media with it.

In bouillon the fluid is clear. At the end of ten days the spores form a cottony growth on the surface of the fluid. The growth is slow on potato.

The most interesting experiments are those of Liebman (quoted by Chrétien). This observer was able to grow the streptothrix on plants. Inoculating the seeds of beans, lentils, and barley, the plants and the parasites developed simultaneously. The plants were invaded by short, rod-like bodies, and the streptothrix was also found in the forms common in animals. These could infect animals and also grew on inoculation into other media.

I have attempted this method of culture a number of times with invariable failure.

Liebman pointed out that the streptothrix actinomycotica, contrary to most organisms, becomes attenuated by passing through the animal body, but regains its virulence after being grown on a plant.

According to the same author the resistance of the organism is very great. He found that it would resist boiling for fourteen minutes and dry heat of a temperature of 140° to 145° F. for four or five hours. He also found that 5 per cent. carbolic acid solution had but little effect, and that it took a 1 to 1000 solution of bichloride to kill them in five minutes.

Other observers place the resistance under what Liebman gives as the maximum vitality.

Inoculation Experiments.—The first successful inoculation experiments were made by Johne in 1880. These experiments have been repeated by many observers since. The disease can be produced both by the introduction of the sulphur granules direct and from cultures. No one has yet succeeded

(as far as I can ascertain) in producing the disease by mixing the parasite with the food.

Pathology.—The organism having found a lodgement in the tissues, it grows out in the manner described above in the account of the colonies. At first there is a poisoning of the cells in the immediate neighborhood of the streptothrix. This leads to a hyaline degeneration of the cells and then to a necrosis, so that in the stained specimen the colony is seen surrounded by a mass of homogeneous structure which stains well with eosin. The nuclei of the cells of this area either do not stain at all with nuclear stains or show fragmentation. This area is more or less invaded with small, round, mononuclear cells similar to those found in tubercular processes. Later on the zone is seen to contain epithelioid cells and occasional giant-cells. These are generally more numerous in the outer portion of the zone. The process excites the proliferation of the fixed connective-tissue cells, and there is the formation of new connective tissue about the foci of infection. This undergoes the usual change of induration, and we soon have a tissue which is made up of bands of connective tissue passing in various directions. The interstices are filled with the masses of the streptothrix with their attendant zone of small, round, mononuclear, epithelioid, and giant-cells. In some cases the production of new tissue is excessive, and these are the cases which partake of the nature of a new growth. The connective tissue may invade the places occupied by the streptothrix, and by overgrowth, as it were, crowd out the organism and produce a spontaneous cure. This happy termination does not occur very often, but instead the ends of the streptothrix grow out in various directions following the lines of least resistance, and so cause new foci of infection. These extensions may be in tissue which is apparently normal, as shown in the researches of Leser.

There may be an over-production of the streptothrix inside of one of the interstices, and this leads to a breaking down of the tissue. If it is near the surface, a sinus results, through which the sulphur granules and the pus are discharged.

Another frequent occurrence is for the mass to soften and to become an abscess. These are frequently mistaken for ordinary abscesses. When they open and discharge their contents, they most frequently leave behind them a sinus which continues to discharge. This process may or may not be attended with extensive formation of connective tissue.

Statistics.—A study of the statistics of the cases of actinomycosis, as collected by different observers, presents some interesting points. Let us glance first at the disease as it occurs in cattle. Poncet and Bérard cite the following collected from the authors stated: Claus, of Bavaria: Jaw, 51 per cent.; tongue, 29 per cent.; lungs, 2 per cent.; skin, 0 per cent. Mari, of Russia: Jaw, 32.8 per cent.; tongue, 1 per cent.; lungs, 5.6 per cent.; skin, 51 per cent.; submaxillary and bronchial glands, 11 per cent. Leclerc, of France: Jaw, 72 per cent.; tongue, 18 per cent.; lungs, 9 per cent.; skin, 0 per cent.

From a casual study of the above, it will be seen that the jaw is the seat of election in all countries except Russia, where the skin is the most frequently affected. Just to what extent Mari's figures can be trusted I am unable to state. The disease in the tongue, of comparative frequency in France and Bavaria, is rare in Russia.

In Germany, in 1887, Moosbrugger published his collected statistics of the disease as it occurred in that country, including seventy-three observers. This was the first attempt at collective investigation of the disease in man. His figures are as follows: Head and neck, lower jaw, mouth and throat, 29; upper jaw and cheek, 9; tongue, 1; digestive tract, œsophagus, 2; intestines, 11; bronchi and lungs, 14; port of entry unknown, 7; total, 73.

Leith gives the anatomical distribution of 393 cases as follows: Head and neck, 207; tongue, 13; pulmonary, 52; abdomen, 88; skin, 10; doubtful, 23.

Illich tabulates the results of fifty-four observers of 421 cases as follows: Head and neck, 234 cases,—55 per cent.; abdomen, 89 cases,—20 per cent.; lungs, 58 cases,—15 per

cent.; skin, 11 cases,—2.5 per cent.; primary lesion unknown, 29 cases,—6 per cent.

Sokolow, in Russia, gives sixty-two collected cases: Head and neck, 33 cases,—53 per cent.; intestines, 8 cases,—12 per cent.; lungs, 18 cases,—30 per cent.; origin doubtful, 3.

Guder, in Switzerland, found twenty cases as follows: Face and neck, 11 cases,—50 per cent.; abdomen, 6 cases,—21 per cent.; lung, 3 cases,—13 per cent.

In France, Poncet and Bérard have collected sixty-seven cases: Face and neck, 54 cases,—85 per cent.; thorax and lungs, 8 cases,—15 per cent.; intestines and abdomen, 3 cases; limbs, 2 cases.

Rutimeyer gives the percentages as follows: Jaw, 50 per cent.; lungs, 20 per cent.; gastro-intestinal tract, 15 per cent.; unclassified, 15 per cent.

The fifty-eight American cases are as follows: Seat of the primary lesion as near as they could be determined from the reports: Lower jaw, mouth, and throat, 19; upper jaw and cheek, 8; total head and neck cases, 27; bronchi and lungs, 11; intestinal tract, 16; skin, 3; breast, 1; total 58.

Fourteen of the above cases are reported for the first time. Two of them have been reported before societies. There have been several other cases recognized in this country, but I have been unable to obtain the data concerning them.

Combining all the above figures, we get the following results (one should bear in mind that these figures will not be exact, as some of these cases must have been counted by the different observers): Total number, 1094,—percentages approximate: head and neck, 604,—56 per cent.; digestive tract, 223,—20 per cent.; pulmonary, 164,—15 per cent.; skin, 26,—2 per cent.; doubtful, 63,—6 per cent.

Omitting Moosbrugger's and Leith's figures, to eliminate as far as possible the error of counting one case twice, and we get 628 cases as follows: Head and neck, 359,—55 per cent.; digestive tract, 132,—19 per cent.; pulmonary, 92,—14 per cent.; skin, 16,—2 per cent.; doubtful, 33,—5 per cent. It will be seen that these cases correspond very closely with those given by Rutimeyer.

Blood.—In all cases where a blood examination has been made there is a slight leucocytosis. Ewing had a case where the leucocytes reached 21,500. In Rosenthal's case there were 12,000 white blood-corpuscles, 4,250,000 reds, and hæmoglobin 80, on von Fleischl's scale. In Hoover's case there was a slight relative leucocytosis, the differential count showing small mononuclears, $2\frac{1}{2}$ per cent.; large mononuclears, 12 per cent.; and polynuclears, 85 per cent. The specific gravity of the blood, in his case, was 1.044, and the hæmoglobin 50, on von Fleischl's scale.

In Latimer's case there was a well-marked myelogenous leukæmia, which may be regarded as a coincidence.

Clinical History.—The clinical history of a disease so varied in its manifestations presents some difficulties in its description. In this it resembles tuberculosis. It can best be studied by considering in turn the various regions of the body affected. For the sake of completeness the divisions given by Poncet and Bérard will be quoted. The American cases do not cover all these divisions, so in the cases considered a shorter classification has been used. Where the importance of the subject justified it I have quoted cases from foreign literature to illustrate the points in question.

Poncet and Bérard's classification :

Cervical facial.

Acute.

Subacute and chronic.

Temporo-maxillary.

Gums.

Submaxillary.

Perimaxillary.

Free cervical.

Peripharyngeal and perilaryngeal.

Maxillary.

Tongue.

Lachrymal ducts.

Cranio-cerebral.

Thoracic.

Œsophagus.

Lungs.

Abdominal.

Appendicular-cæcal.

Beginning in the stomach and other portions of
the intestines besides the cæcum.

Secondary lesions in the liver.

Gastro-intestinal.

Pyæmic.

Skin and extremities.

Nodular form.

Ulcerated form.

Pseudo-actinomycosis.

In the American cases which I have collected the cervical facial forms can be grouped under three heads: Those involving the upper jaw and cheek; those involving the lower jaw and adjacent tissues; and those involving the soft structures. Any finer classification than this is unsatisfactory, owing to the meagreness of the details.

The disease, as it is found attacking the upper jaw and cheek, may resemble one of two things,—either an ordinary inflammatory process or a sarcoma. In both cases pain is a prominent feature of the disease, and this with the swelling are the first noticeable symptoms. In the first instance the disease may attack the antrum of Highmore, and from there spread to the cheek, so that it involves the articulation of the jaw and the tissues below it. The appearance of new points of the disease is often first noticed in an œdema of the part affected (see cases of Tiffany and Ochsner). The absence of the involvement is an important point in the diagnosis. Carious teeth in this as in the cases where the lower jaw is affected seem to play an important etiological rôle.

The following case may be regarded as one in which the infection took place directly from the diseased animal:

CASE I.—A. J. Ochsner (*Medical News*, Philadelphia, 1891, Vol. lviii, p. 97); male, aged fifty-three, farmer; seat of infection, jaw. Illness began eight months previous in the left antrum of Highmore. Had four teeth removed from the upper jaw, but without relief. Abscess formed and pointed near the canine fossa. This was opened by his physician once, and twice spontaneously. Skin surrounding the sinus thickened and infiltrated. A drop of pus squeezed out contained actinomyces. Place was curetted some distance, bone removed, and swabbed with 95 per cent. carbolic acid. Healed and did well until October, when an œdematous mass appeared above the left ear. Opened and packed. After this patient did well. For six months previous to his illness patient had driven a horse supposed to have a "lumpy jaw."

The following case illustrates very beautifully the infection of the lungs from a lesion situated above:

CASE II.—A. J. Ochsner (*Journal of the American Medical Association*, Chicago, 1886, Vol. vii, p. 608). White; male; aged fifty-six years; seat of infection, tooth. Patient had severe neuralgic pain in the left antrum of Highmore. Had seven teeth removed from the upper jaw. All were sound, and he obtained no relief. Pain continued for six months, when abscess opened spontaneously. Had antrum curetted and drained. Irrigated the same for two years. Health much run down at this time, for which he went to Colorado and Mexico. In 1885 he began to cough, several times had bloody expectoration. In 1886 began expectorating blood and bloody mucus. (Unusual in actinomycosis.) Lost thirty-seven pounds in two years. Chest full in front. Stoops some. Decrease in motion on left side of chest with dullness, roughened respiratory sounds, and numerous râles. Actinomyces found in the sputum. Patient had been buying and selling cattle for the past forty years. Many of these suffered from "lumpy jaw." These he treated by incision, curettement, and arsenic (powdered). He states that two applications generally cured.

The treatment of the case consisted in inhalations in a vapor cabinet and the use of bichloride of mercury, 1 to 1000, locally. Residence, Chicago (?) and the West.

One case involving the cheek and jaw was cured after three operations, as is seen in the following:

CASE III.—Dr. Charles A. Powers (reported before the Denver Clinical and Pathological Society. I am indebted to Dr. Powers for these notes). A cattle-raiser, aged fifty, who for years had slept on the ground in Arizona, presented himself with a persistent swelling of the left cheek and jaw. This was cured after three extensive operations. Histologically there was the structure of actinomycotic tissue, but there was never any demonstration of the actinomyces.

The following case resembled a sarcoma of the jaw:

CASE IV.—Nicholas Senn (*Chicago Medical Record*, 1892). Patient was a young man employed on a farm. Five months before he was seen he had a swelling of the jaw, on the right side (upper), and had several teeth removed, under the impression that they were the cause of the trouble. Diagnosis of sarcoma of the jaw was made by the attending physician, and the case was sent to Dr. Senn for operation. Swelling firm with well-defined border, involving the right side of the face and adherent around the alveolar processes of the upper jaw. No evidences of suppuration.

Through an external incision the entire mass was removed and the jaw scraped and cauterized. It healed nicely, and there had been no return up to the time of the report.

The mass removed contained sulphur granules. There were no clubbed ends present, but the ends of the threads were surrounded by spore-like bodies. Residence, Milwaukee and vicinity (?).

The following case occurred in the practice of Dr. Louis McLane Tiffany, of Baltimore, to whom I am indebted for the hitherto unpublished notes:

CASE V.—The patient was a white farmer, aged thirty-six, who resides in Frederick County, Md. About six weeks before being seen he noticed a swelling over the right malar bone. On admission to the hospital, December 9, 1897, there was a swell-

ing in that region, and a swelling, about the size of a hen's egg, at the angle of the lower jaw of the same side. The swelling had been previously opened, and there had subsequently appeared new openings, so that on admission there were eleven new openings in all.

December 15, 1897, the swelling was opened and removed by means of a sharp curette. The wound was cauterized with pure carbolic acid. The diseased tissue extended into the orbit, and the upper and lower jaw were exposed. The disease also extended into the neck. Plain gauze was used in dressing the wound.

December 27: Two points appeared, and were cauterized with carbolic acid. January 6, 1898: Two new points appeared, and were cauterized with carbolic acid. January 22: Temporal fossa curetted and cauterized. February 9: *Right side of forehead became oedematous*. February 12: Temporal fossa, forehead, orbit, and tissues over upper and lower jaw curetted and cauterized with carbolic acid.

After this no more points of the disease appeared. The patient was given iodide of potassium during the treatment.

November 11, 1898: Patient remains well at this date.

The last case of the upper jaw involved the articulation.

CASE VI.—Lange (*loc. cit.*). Sex and age not stated. Seat of infection, a molar tooth. Abscess in temporal region, which invaded the temporo-maxillary articulation. An exsection of the temporo-maxillary articulation was done, following which there remained a small fistula down to the base of the skull. The opening of the mouth and mastication now perfect. Residence, not stated.

The cases where the lower jaw and adjacent structures are involved are by far the most frequent in this country. The cases which are described as the temporo-maxillary might be regarded as the most classical form of the disease. It has a more distinct and constant clinical history than any of the other forms. The most important features are the almost constant sharp *pain* at the seat of the lesion, which is on a level

with the last molars, and extends to the angle of the jaw; the early appearance of *trismus* of varying intensity; and the *swelling* which has a rather boggy consistence. There is also an *absence of involvement of the lymphatics*, which is a constant feature of the disease no matter what the site may be.

The trismus is an interesting feature, and has been regarded as pathognomonic by Poncet and Bérard. It is due to a more or less complete involvement of the muscles concerned in mastication, and may be so severe that the mouth can only be opened for a short distance. In some cases the articulation is affected, and then the stiffness of the jaw is even more pronounced.

The swelling is very frequently of a uniform character. A mass appearing at the angle of the jaw, painful, slightly fluctuating or boggy, with a redness of the skin which has something of the blue in it, and if it is not interfered with, there appear nodulations which break and discharge the characteristic pus. These sinuses remain and continue to discharge. Inside the mouth there may be swelling and the formation of tumor-like masses of the characteristic tissue. There is usually a history of carious teeth, and in many cases the teeth have been removed, as the source of the trouble, before the physician has been called to see the case. Sometimes the teeth so removed have had the sulphur granules adhering to them. The majority of the cases which might be classified differently start as this form. The disease may extend to adjacent structures or form metastases or secondary involvement of the respiratory or alimentary tract, may occur from the streptothrix being drawn into the lungs in breathing or by its being swallowed.

• The following cases illustrate this form very well:

CASE VII.—Dr. L. McLane Tiffany (hitherto unpublished notes). A white farmer, aged thirty-two, residing in Frederick County, Md., had a swelling about one-half inch in diameter over the angle of the lower jaw on the right side. There was indistinct fluctuation. This was opened, and there was an escape of pus containing sulphur granules. These proved to be made up

of the streptothrix actinomycotica. The diseased tissue was removed by means of the sharp curette and pure carbolic acid applied. Healing took place, and the patient remains well at the present time.

CASE VIII.—C. A. Hoover (I am indebted to Dr. Hoover for the above heretofore unpublished notes). The patient was a white laborer, aged forty-three. His previous history was negative, except that about six months before his present illness he had cared for a horse which had an eruption under its jaw.

He entered the hospital on November 25, 1896, and died August 5, 1897. Eighteen months before he had noticed a small lump at the angle of the left lower jaw. This increased rather rapidly. One month later this was opened and drained. The opening never healed. Three months later the area was curetted. A week later another lump appeared lower down. This was opened and healed promptly, but appeared again in about a month.

He was able to return to his work for five months, when he began having severe pain, which persisted until July, 1896, when the pain ceased, and there appeared beneath the jaw and along the anterior border of the sterno-clavicular articulation other nodules, which subsequently opened and discharged thin pus. Following this there appeared tenderness over the manubrium, but this ceased later. The patient was treated in the surgical ward until a few weeks before his death, when he came under Dr. Hoover's care in the medical ward.

At this time the patient complained of pain in the epigastrium and about the umbilicus. This was attended with severe diarrhoea and vomiting. The patient was very anæmic.

Blood Examination.—Specific gravity, 1.044; hæmoglobin, 50 on von Fleischl's scale; slight leucocytosis found on relative count; small mononuclears, $2\frac{1}{2}$ per cent.; large mononuclears, 12 per cent.; polynuclears, 85 per cent.

Cultures from the pus from the cervical sinuses showed the bacillus pyocyaneus.

On examination, scarring and swelling as described above. The red, ragged, and retracted appearance suggested at once actinomycosis. There was slight dulness, with increase of vocal fremitus over the left apex, but no râles. There were no further physical signs pointing to disease in the thorax, and *nothing to*

suggest anything wrong in the mediastinal region. The liver and spleen were both enlarged, the latter reaching three fingers' breadth below the margin of the ribs on expiration. There was moderate tenderness over the epigastrium.

Daily quantity of urine, 800 cubic centimetres; urea, 12.78 per cent. Temperature ranged from 99° to 101° F. Occasionally it would rise to 103°. The patient grew rapidly weaker, presented the signs of shock, and died.

Autopsy was made eighteen hours after death.

Thorax: Left pleura everywhere adherent, the right only at the apex. Contiguous with the process in the neck, the left mediastinum, pericardium, and pleura, for their entire extent, are studded with small tubercles, varying in size from that of a mustard-seed to that of a grain of rice. Over the pulmonary region this process is restricted to the pleuræ. The pericardium has been invaded until there is complete synechia cordis. The epicardium contains as many as twenty-five tubercles, varying in size from that of a mustard-seed to that of a lentil. They are irregularly distributed, and invade the myocardium to a very slight extent. The peribronchial glands are enlarged, greenish black in color, and cheesy in consistence. The myocardium and the endocardium are free. This same process extends downward behind the diaphragm, involving the retroperitoneal lymph-glands, which are enlarged and have undergone cheesy degeneration. They present much the same appearance as a chain of tuberculous lymph-glands. This same process has involved all the structures in this region,—the liver, spleen, stomach, duodenum, and transverse colon. It extends as far down as the bifurcation of the aorta. The lumbar vertebræ are not involved. The pancreas is involved to a slight extent only. The posterior wall of the stomach has been invaded by contiguity, and there are nodules as large as a hazel-nut, involving as far as the mucosa, and in some cases even that. Some of the nodules are liquefied. In some places there are sinuses leading from these to the inside of the stomach. There is quite a large pus-cavity near the pylorus. There is one ulcer in the duodenum, and then no more in the intestinal tract until the transverse colon is reached. This is in the same condition as the stomach. The liver contained one nodule, surrounded by a fibrous capsule, one-half centimetre thick. Spleen and kidneys were both involved.

During life it was never possible to demonstrate the streptothrix actinomycotica. This was done at the autopsy. Unfortunately I have been unable to secure the laboratory notes on this case.

CASE IX.—J. B. Murphy (*Chicago Medical Record*, February 12, 1892). Patient was a male, aged eighteen. Ten months previous, while in Ireland, had a severe toothache for two months. Then a swelling appeared at the angle of the jaw, and the pain subsided. Since then the swelling has become painful and has gotten somewhat larger. When seen the swelling was as large as a pigeon's egg and fluctuated. Induration was present in the surrounding tissues. On aspiration a few drops of pus were obtained, and a few days later there appeared a flow of pus which contained the actinomyces. The sinus was scraped out twice, and the second time a drainage-tube was inserted. This healed, and then recurred at the end of ten days. After another operation it healed again. Residence, Chicago.

CASE X.—(*Ibid.*) About two months before the operation the patient, a female, aged twenty-seven, had a triangular swelling of the lower jaw. This opened spontaneously at the angle of the jaw. There was very little pain; the principal difficulty was in mastication. This was relieved somewhat when the swelling was opened. Other infiltrations followed, and when first seen the swelling had involved the tissue for three inches below the jaw, all the parotid region, and evidently the gland itself. One of the fluctuating nodules was opened, and was found to contain sulphur granules, which proved to be the actinomyces.

The infiltration then extended into the cheek and as far as the nasal articulation.

The operation consisted in removing the affected tissue. The wound healed nicely, and there was no return. Residence, Chicago.

CASE XI.—Weller Van Hook (case referred to at a medical meeting, and mentioned in the same reference as Dr. McArthur's case. I am indebted to Dr. Van Hook for the following notes). The patient, a young laundryman, who had never been about barn-yards, straw, or animals, had two or three sinuses opening externally back of the angle of the lower jaw. Discharge contained actinomyces.

The diseased tissue was scraped out, and there was never any return. Residence, Chicago.

CASE XII.—G. A. Bodamer (*Medical News*, 1889). Patient was a white male, aged thirty-two. He was wounded on the head in 1881 by a falling prop. He was a miner, and was working in a mine at the time. He had numerous cuts about the head. Afterwards, time not stated, had a swelling at the angle of the jaw on the right side. This swelling would come and go. In 1882 became larger and permanent. It was then poulticed, and he had the upper and lower molars removed. Teeth were sound, and he was advised to keep the gums open to cure the swelling. Growths made their appearance, filling up both, in the upper and lower jaw, the spaces left by the teeth. The swelling was opened in an accident. It bled freely, and then healed promptly. In 1884 had the swelling removed.

Re-entered the hospital in 1888. In the mean time he had sustained numerous injuries to the jaw. There was also a swelling from the clavicle to the temporal region, on the right side. This consisted of an indurated mass of infiltrated tissue, involving half of the temporal muscle, the buccal muscles, the upper and lower jaw, and the gland and connective tissue. There was ankylosis of the jaw, and the opening between them was only about a quarter of an inch wide. *Deglutition was apparently not disturbed.* There were two external fistulæ, and one opening into the mouth. There were evidences of other fistulæ which had healed. The pain was slight, increased on pressure, and somewhat worse at night. Sulphur granules, exuding from the openings suspended in a grayish viscid fluid, proved to be the actinomyces.

The diseased tissue was removed at two different operations. The result is not stated. Residence, Luzerne County, Pa.

CASE XIII.—W. P. McGovern (*Medical News*, 1892). Patient, a male, had a swelling, the size of half a lemon, appear at the angle of the jaw on the right side. There was no fluctuation, and the tissue about the tumor was infiltrated. The skin was reddened over the central portion of the tumor. Last molar, on the right side, is carious, and the whole mouth gives evidence of inattention. Tumor incised and sulphur granules found in the pus. The tooth was drawn and two sulphur granules found adherent to it. One was on the root and the other in the cavity of

the tooth. Cavity was syringed out daily with antiseptic solutions, and one day the mass was touched with nitrate of silver. Improvement was so great that this was done every few days. In two months' time there was complete cure. There has been no return of the trouble.

CASE XIV.—W. W. Van Arsdale (ANNALS OF SURGERY, 1895). Patient was a female, aged thirty-four. There was a swelling in the parotid region that spread forward, which the patient said was from a carious tooth. Face showed thick, indurated excrescences, which could be traced under the skin. Injections were practised, twice a week, with a solution of fourteen grains each of cinnamyl and muriate of cocaine in four ounces of alcohol. Ten or twelve minims were injected at a time. Had heard of this from Landerer, who had used it for a different purpose. Cure resulted. Residence, New York.

CASE XV.—F. Hartley (*New York Medical Journal*, 1889). A case came under his notice at the Roosevelt Hospital. In this case there had been previous history of bad teeth. The lesions were in the jaw. Patient was a girl thirteen years old. Residence, New York.

Other Cervical Facial Cases.—There are a number of points about the disease in its occurrence which it is very important for the clinician to bear in mind.

The disease may occur as an ulceration of the mucous membrane lining the mouth. There have been two such cases in this country. In both the peculiar discharge led to a diagnosis. In one of the cases it extended through the cheek after having existed in a rather quiescent state. The following are the notes of the cases referred to:

CASE XVI.—F. Hartley (*loc. cit.*). The patient was a man, aged twenty-two, who had an ulcer on the inside of his cheek for some time. This suddenly started to spread, and continued until it involved a large portion of the skin of the right cheek. The discharge was examined by Dr. Prudden, who made the diagnosis. Residence, New York.

CASE XVII.—F. Hartley (*loc. cit.*). A little girl who had an ulcer inside of her cheek, attention being called to it by the peculiar discharge. Diagnosis made on examination of this.

The soft structures about the jaw may be involved and the lesion may be limited to this or it may spread to the adjacent tissues. The disease about the gums is generally manifested by the appearance of a fungus-like mass of granulation tissue about a carious tooth, and there are generally sinuses which discharge into the mouth. This may spread to the tonsils, and it may also cause a swelling of the cheek with a bluish-red discoloration of the skin or in some cases a glossy smoothness.

The outlook in these cases is better than in the others and there is less pain and little or no trismus.

The following cases are of this type:

CASE XVIII.—Nicholas Senn ("Surgical Bacteriology," Philadelphia, 1889, p. 227). The patient was a German, a soda-water manufacturer, aged thirty. His history was negative, and there had been no contact with animals. The seat of the infection was the jaw. During the winter of 1886 he had a "cold," and the right side of his face became swollen and painful. One molar was diseased and was removed. This gave no relief, so all the molars on that side were removed.

Patient was admitted to the hospital six months after the first symptoms. Lower jaw presented a fungous mass, and there were several sinuses discharging into the mouth. The growth of the morbid tissue extended as far as the tonsil. The cheek was swollen and the skin over it glossy and painful. The superficial veins were enlarged.

The infiltrated part was dissected out and the external wound healed by first intention. The mouth wound healed by first intention, and for six weeks the patient did nicely. Then there was an involvement of the neck below the scar with the formation of abscesses as far back as the scapula. The patient died four months after the first operation. Residence, Milwaukee.

CASE XIX.—J. B. Murphy (*Chicago Medical Record*, February, 1892). Female, aged fifty-five, had a small tumor on the lower jaw opposite the first molar. It was movable, and it fluctuated. It was first noticed a month before, and was accompanied at that time with severe toothache. The tooth was ex-

tracted but the swelling remained. It enlarged slowly. Actinomyces found on puncture. The swelling was dissected out, and the wound healed by primary union. There has been no return. Residence, Chicago.

The rapid recovery is the feature of note in the following:

CASE XX.—E. L. Brown (*Chicago Medical Record*, 1894, Vol. vii, p. 251). Patient was an Austrian, who came to Chicago in 1888, and was employed in a machine-shop.

One month previous had a severe pain in a defective tooth. The pain spread over the entire side of the head. A few days later a swelling appeared half an inch below the left angle of the mouth. This opened externally, and discharged a quantity of pus, and persisted as a running sore. A few days later he had a second swelling below the first, and in a few days more another one. The openings were raised and reddened. There was no lymphatic enlargement. There was considerable induration about these swellings. The pharynx and tongue were swollen and there was difficult deglutition. The discharge contained the sulphur granules.

Peroxide of hydrogen and perchloride of mercury were used locally and iodide of potassium internally, in ten- to fifteen-grain doses. At the end of a week he was able to be about the house, and at the end of the second week was able to return to his work. Residence, Chicago.

Submaxillary Form.—When infection tends to go downward instead of towards the angle of the jaw, the clinical picture is not unlike that produced by a tubercular adenitis in one class of cases, while in another the tissues about the base of the tongue are involved with difficulty in swallowing and sometimes in breathing. Illich cites a number of cases where the submaxillary gland was involved, and where the disease was principally confined to the gland and its capsule. The infection in these cases evidently takes place through Wharton's duct.

In the first of the cases quoted below there is an interesting point, in that it was thought at first to be a case of syphilis. The supposed gumma turned out to be of actinomycotic origin.

CASE XXI.—Dr. L. Weber (I am indebted to Dr. Weber for the hitherto unpublished notes of the case). Patient was a merchant of fifty-two, robust and active. History of syphilis. There had been no active symptoms for five years. Patient complained of pain and tenderness in the right submaxillary region. He supposed that it came from a tooth and had it drawn, but without relief. The swelling resembled a gumma of the jaw so much that the patient was put on iodide of potassium. The swelling increased rapidly in size, and two months after its appearance there was a dusky appearance of the skin with deep-seated fluctuation. Aspiration revealed the actinomyces. Diseased tissue removed, and healing took place in about two months' time. There has been no return in the past three years. The patient had spent the preceding fall in the country where he was in the habit of chewing heads of wheat. Residence, New York.

CASE XXII.—Weller Van Hook (I am indebted to Dr. Van Hook for these hitherto unpublished notes). The patient was a farmer, aged fifty-five, markedly alcoholic. Swelling appeared in the submaxillary region on the left side. The second molar on that side was extracted. This was found to be carious, but no relief followed. The swelling increased for four or five months. When seen the swelling was about the size of a hen's egg, and was adherent to the inferior maxilla, over which it was immovable. The swelling was hard, diffuse, and indistinctly outlined. The skin was adherent to it, especially over the most prominent part, where two sinuses opened. The skin about these sinuses was bluish and thin. The discharge from them was a thin serum-like pus, which contained the actinomyces.

On opening the mass the sinuses were seen to run in various directions, honeycombing the superficial fascia. The periosteum was involved and in some places the bone was denuded. Lymphatics were not affected. The site of the disease was thoroughly curetted. After three months he returned and stated that the disease was spreading. It had extended downward for two inches in the superficial tissues. After another cleaning out the patient returned home. After five months there had been another return. A most reliable operation was done, all the affected tissue widely removed, and the jaw resected. The wound healed nicely, but a sinus remained, which soon began to

discharge sulphur granules. He was given increasing doses of iodide of potassium, but no effect was ever noted on the disease. After four or five months of systematic drinking he died supposedly from a basal meningitis.

The following case showed involvement of the submaxillary gland, with a more extensive involvement of the other parts, including the tonsil:

CASE XXIII.—G. Minges (spontaneous recovery of a case of human actinomycosis inoculated into a rat, *Tri-State Medical Journal*, St. Louis, 1895, pp. 263-266). The patient was a female, aged six. The disease began with redness and swelling of the left tonsil and the adjacent structures. The left submaxillary gland was also swollen. Both the upper and lower teeth were in bad condition. Two weeks later the left cheek became hard and swollen and the breath very fetid. Two weeks later this swelling opened with the discharge of a considerable quantity of foul pus, and this was followed by a subsidence of the symptoms.

In two weeks the swelling had returned, and it had the appearance of a sarcoma. The edges of the incision had a pouting appearance. Caries of the jaw was suspected, and another incision made. A small quantity was evacuated. A few days later the sulphur granules appeared in the pus. Ten days later the swelling had again returned. Three months later the swelling had subsided, but there was a half-dozen regular, hemispherical, brownish-red tumors, three-quarters of an inch in diameter. One of these was behind the ear. The original incision was still discharging. Six months later these opened and healed. Flax-seed poultices had been used by the parents, and they refused to use the iodide of potassium, as they were giving the child medicine from a spiritualist. Later on the drug was used with benefit, and the child was cured. Residence, Dubuque, Iowa.

The inoculation experiments made are not of sufficient interest to detail.

The last three cases show a more extensive involvement of the tissues below the jaw. In the first there was a tumor along-side of the thyroid cartilage. The disease often extends about the larynx, but the interior generally escapes. In the

second case gangrene and pyæmia supervened, and in the third the maxilla itself was affected.

CASE XXIV.—Northrup (*loc. cit.*) reports a case of a butcher who had a tumor, the size of a horse-chestnut, along-side of the thyroid cartilage. It communicated with the jaw and a carious tooth by a sinus. Along this were scattered yellow, seed-like bodies, having the size and general appearance of miliary tubercles. The man wished to know if he had the same disease which affected cattle "with the little pearls." Residence, New York.

CASE XXV.—Justus Ohage (*Northwestern Lancet*, 1893, p. 1). The patient was a steam-boat captain, aged thirty-five. One year previous had a painful swelling of the jaw caused by carious teeth. Extraction gave only temporary relief. Abscesses formed in several places about the jaw and neck. Swelling became very pronounced, involving the side of face and neck. This became gangrenous, a pyæmic condition supervened, and the patient died.

Sulphur granules were in the pus from the fistulæ. Residence, Osceola, Wis.

CASE XXVI.—J. B. Murphy (*New York Medical Journal*, 1885, Vol. xli, p. 17). Patient was a female servant, aged twenty-eight. Trouble began with toothache in the left lower teeth, accompanied with swelling of the throat and great pain in swallowing. After using poultices for several days the swelling disappeared, to return a few days later. An abscess formed and was lanced, a large quantity of pus escaping. Rapid recovery from this, but in a week there was the formation of another swelling below the angle of the jaw, in the tissues of the neck. This was the size of a walnut, and the tissues about it were indurated. There was fluctuation, but there was only a little pus in it. Drainage-tube was inserted, and through this pus containing sulphur granules escaped. The mass was removed and the site curetted, the carious teeth drawn. The angle of the jaw was opened, and the alveolar canal cleaned. Primary union resulted. Residence, Chicago.

A word or two may be added about the disease as it occurs in the cervico-facial region.

The peripharyngeal cases are always to be feared, as it is

from these that the disease may and does so frequently extend into the orbit, into the cranial cavity, into the ear and the mastoid cells, and lastly into the respiratory or intestinal tract. In the former cases by direct extension, and in the latter by aspiration into the lungs, or by swallowing the organism.

Maxillary Forms.—These are of two varieties, but I have made no attempt to illustrate them from the American cases, as the careful studies in this direction have been made mostly by European observers.

The two forms are central and peripheral. The peripheral may be either rarefying or ulcerating. The central may be of the inflammatory type, or it may partake of the characters of a new growth.

The first form appears to be more rare than one would suppose, if recent observations by Noorden, Illich, Boström, and others, who have carefully examined the small pieces of bone which have been removed in cases of actinomycosis, are to be credited. The observers were for the most part unable to make out any trouble in the surrounding bone, the trouble being in the surrounding tissues. In some few cases the organism had invaded the bone.

The second form is usually of the inflammatory type. The cases where it takes the form of a neoplasm are very exceptional. In cattle this is, however, the usual form. In man there have been several cases reported which approach that type. Among these are the interesting cases of Ducor and Poncet (*Gazette des Hôpitaux*, 1896) and of Legrain (*Archives de Parasitologie*, 1898, cited by Poncet and Bérard). In the latter case there was a definite increase in the size of the lower jaw-bone. At one place it was the size of a hen's egg.

Tongue.—The disease, as we have seen, is not uncommon in the tongue of cattle, but in man it is of rare occurrence. Illich has collected twenty cases from the literature, and Bonnet, of Lyons, has written a thesis on the subject.

The disease here has two stages. The first, when there is a small tumor-like growth in the tongue, and the second when

this is ulcerated, either having been opened by the surgeon or spontaneously.

There is usually a history of injury to the tongue, against the teeth, or by some foreign body, as the blade of some grain. The distinguishing characteristics are its slowness of growth, and the fact that the nodules are isolated and well defined. Aspiration may or may not yield pus containing the fungus. Most of the cases did well on being opened and drained. There was also the coincident administration of iodide of potassium. In this locality the disease may be confused with syphilitic, tubercular, and epitheliomatous conditions particularly, and sarcoma should be borne in mind.

Lachrymal Ducts.—Of interest to oculists is the fact that the disease has been described as occurring in the lachrymal ducts. The first case was reported by Thomassoli in 1894 (*"Bacteriologie et Parasitologie cliniques des Paupières,"* Paris). Three cases have been reported by Schröder and subsequently by Elschning (*"Actinomyces im Thränenrohrchen," Klinische Monatsblätter für Augenheilkunde, Band xxxiii*).

The characteristic sulphur granules were present as a diagnostic feature, and there was an accompanying inflammation of the conjunctiva in the angle of the eye.

Thyroid Gland.—This organ has been affected frequently by extension of the infective process.

In the case of Kohler (*Berliner klinische Wochenschrift, Vol. xli, p. 927*), a woman, of twenty-five, who worked in a dairy, had a progressive myxœdema, and, after several months, it was found that the gland had been infected with the parasite, and almost all of both lobes destroyed. It was opened and drained. A small piece of the gland remaining, a cure resulted.

Cerebral Actinomycosis.—Most curious and interesting are the cases where the organism has invaded the central nervous system. The brain and spinal cord may be affected together or separately, and invasion may take place by direct extension or by metastasis. There have* been no American

cases where the nervous system has been invaded, but the following cases from foreign sources are of interest:

CASE XXVII.—Otto Keller ("Trephining in a Case of Actinomycosis of the Brain," *British Medical Journal*, March 29, 1890). Woman, aged forty. She had a pleurisy in 1885, and the following year had an abscess over the cartilage of the sixth rib, and another over the eleventh rib on the left side. These contained the streptothrix actinomycotica. They healed after operation.

Two years later had a gradual-increasing weakness of the left arm, followed by convulsions. After this there was a paralysis which later on involved the leg and the face, on the same side. Headache and vomiting and later on loss of consciousness and deep coma. When the patient was apparently moribund the family at last consented to an operation. The skull was opened over the middle right ascending convolution. On incising the dura mater two ounces of greenish actinomycotic pus was evacuated. The patient immediately roused and called for water, no anæsthetic having been given. Consciousness returned the next day, and eight days later facial paralysis disappeared, and she could move her leg. In six weeks she got up, and there remained contraction of the fingers and weakness of the left arm. After two months the wound healed, but towards the end of the year the symptoms returned. A second operation was done, and more pus let out, but the patient died a few days later. At the autopsy newly formed tissue was found over the right frontal and parietal convolutions, and a small encapsulated abscess was found in the white matter.

The foregoing case illustrates cerebral infection by metastasis as well as other remarkable features. The following history shows how direct extension may affect the brain:

CASE XXVIII.—W. B. Ransom (*British Medical Journal*, June 27, 1896, p. 1553). A woman, aged thirty-two, had pain in the temple with some ptosis and limitation of the movements of the eyeball. Bulging of the eyeball followed with an opening at the outer canthus with discharge. There was a temperature of

100° to 103° F., mental irritability and confusion, followed by coma and death. There was no optic neuritis.

The autopsy showed inflammation with pus-formation in the infundibulum and ocular nerves. The antrum was full of pus. There was a sinus leading from the orbit to the gum; reaching the orbit, it crept along the outer wall, and in the wall of the right cavernous sinus to the base of the brain. Ultimately it set up meningitis with the formation of small abscesses, and burrowed through the pituitary body and sella turcica to the cavernous sinus on the left side. The patient had taken iodide of potassium without result.

The following history shows the clinical picture in a case where the brain and spinal cord were both involved:

CASE XXIX.—Xavier Delore ("Actinomycosis Cerebro-Spinal," *Gazette hebdomadaire*, May 24, 1896). Patient had a cervical facial actinomycosis. Began to complain of pain in the legs. Four days later had loss of consciousness with mild delirium, dilated pupils, and slight strabismus. Two days later there were frequent convulsions, opisthotonos, and œdema of the papillæ. The next day trephined with amelioration of symptoms. The next day there was a return of the symptoms. Death eight days later. In the spinal canal, from the sacrum to the cranium, there was found a pachymeningitis with yellow grains in the pus, both inside and outside of the dura mater. The same condition was found in the skull. The cranial bones were not affected. The streptothrix actinomycotica was demonstrated biologically in the pus from the cord.

(To be continued.)

SOME OBSERVATIONS ON THE SURGERY OF THE GALL-BLADDER AND THE BILE-DUCTS.

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DURING the past eight years 105 operations have been made on the gall-bladder and the bile-ducts in St. Mary's Hospital, Rochester, Minnesota. It has been thought by the writer that an analysis of these cases, with particular reference to the results and with some remarks on the technique, might be of interest.

To confine this within readable limits, only such reference has been made to the voluminous literature as seemed necessary to a proper presentation of the subject-matter.

For gall-stones in the gall-bladder or cystic duct, or both, cholecystotomy was performed sixty-four times with one death, four of these cases required separate incision of the cystic duct for the removal of an impacted stone, and in three cases soft stones in the duct were crushed.

Four of the sixty-four cases required secondary operations. Two for the removal of gall-stones overlooked at the primary operation. One for the relief of biliary fistula, probably due to putting the gall-bladder on the stretch by too low an attachment to the external incision.

The fourth had a cystic accumulation, caused by a stricture in cystic duct. In addition, three cases had more or less trouble after healing of the fistula, due to inefficient drainage through the cystic duct, and in two of these the wound has reopened several times with discharge of retained secretion.

In eight cases cholecystotomy was made for the relief of

infection of the gall-bladder, the ducts or both, with one death fourteen days after an operation for suppurative cholangitis.

Two cases of infective cholangitis were operated upon, both recovering. In these two cases the gall-bladder was shrunk, and it contained no stones, although there probably had been a previous cholelithiasis. In the remaining five cases the suppurative process was confined to the gall-bladder, and in four, stones were present. In one a secondary operation has since been performed for retention cyst, and in another there is a mucous fistula present at this time. It will be noticed that, in the total of seventy-two cases of cholecystotomy that there were two deaths, and seven cases in which the gall-bladder continued to give trouble from causes not connected with the stone-formation.

In all of these cases of failure to cure by cholecystotomy, there has been an obstruction to drainage through the cystic duct. The obstacle is usually a stricture due to an ulceration in the duct from prolonged lodgement of a stone or, as pointed out by Christian Fenger, to angulation of the duct. The mucous membrane continues to secrete and colicky pains attend the forced passage of the secretions.

M. L. Harris remarks that the small gall-bladder firmly contracted on stones is especially liable to subsequent attack of recurrent regional peritonitis, and this has been our experience. After the removal of the external drainage, the thickened walls of the gall-bladder continue to contract, interfering with the drainage through the ducts from the islands of mucous membrane not previously destroyed, and a condition results resembling a chronic appendicitis in many respects. In such cases, and in all cases in which a stricture is already present in the cystic duct, cholecystectomy should be performed.

In the seven cases in which further trouble was experienced cholecystectomy, or removal of the mucous membrane of the gall-bladder, which amounts to the same thing, would have resulted in cure.

Cholecystectomy was made four times, all recovered. Once only as a primary operation in a case of acute gangrenous

inflammation of the gall-bladder, once for biliary fistula, and twice for recurrent cholecystitis.

Choledochotomy was performed for stones in the common duct eleven times, with recovery in each instance. In eight of these cases the gall-bladder was shrunken, and in only five did it also contain stones. One was a typical example of the ball-valve stone described by Fenger, all of these cases have remained well, the gall-bladder giving no further trouble. The fact that the cystic duct was able to pass the stone would indicate that drainage was free, as previously remarked, such a gall-bladder firmly contracted upon the stone would argue to the contrary, and clinical experience demonstrates the correctness of this view.

Cholecystenterostomy was made once with the Murphy button for a stricture of the common duct, which had caused jaundice for eight months in a man seventy-one years of age (previously reported), the patient recovered, and remained well for more than six years, eventually dying of other causes.

In three cases a gall-bladder, fastened by adhesions to the adjacent viscera, gave rise to pain and gastric symptoms. In these cases the history of colics in previous years warranted the belief that stones had once been present. Liberation of the adhesions relieved the symptoms.

In seven cases an exploratory incision was negative, no gall-stones being present. In two of these a diseased appendix was found to be the source of trouble. Dietl's crisis from a movable kidney proved to be the real difficulty in another, and in four, no cause for the symptoms could be discovered. This gives ninety-eight operations and explorations upon the gall-bladder and ducts for non-malignant disease, with a mortality of two.

For malignant disease, involving the bile-tract, seven operations were performed, four cholecystotomies, one cholecystenterostomy, and two exploratory incisions, with three deaths. In five of these cases jaundice was present, and the gall-bladder was distended with clear mucus. In three, a small

quantity of bile-stained serum escaped on opening the peritoneal cavity.

The results merely substantiate the well-known fact that, in the great majority of cases of malignant disease involving the biliary apparatus, operation is contraindicated.

The straight incision of Tait, either through the rectus muscle or at its outer margin, was employed until two years ago, since which time the Bevan incision has been made use of in the majority of cases. The latter gives a larger space for work and is easy of closure. The so-called "ideal" operation of cholecystotomy with immediate suture has not been employed.

Theoretically, it does not appear to be a scientific procedure, as it does not furnish drainage to the accompanying cholecystitis, and there is nothing to prevent the formation of stones in the future.

The normal position of the gall-bladder makes the fundus dependent, given an infection, with a sluggish bile current, and the deposit of sediment and formation of stone is mechanically easy. It would seem that the cases of typical colics in which stone are not found might be due to the occasional emptying of the gall-bladder by muscular contraction, causing great pain as the sediment or mucus passes. When the fundus is sutured into the external wound the necessary elevation brings the cystic duct more nearly at the bottom, so that the mechanical conditions in preventing sedimentation and stone-formation are even better than in the normal individual. Our observation has been that the cases of cholecystotomy, in which all the stones have been removed and the ducts were free, have had no further trouble, and this without any changes in the habits of the individual, which might contribute to the result. The fixation and elevation of the fundus permanently drains the gall-bladder through the cystic duct, which has become the most dependent part, and gravity alone is effectual.

The gall-bladder has been opened and the stones removed before suturing it into the incision, with the exception of two cases of suppurative cholecystitis. The after-treatment was

very prolonged in these two cases, and the writer believes that, notwithstanding the success of Riedel by this method, with proper protection, even septic cases should be opened and carefully examined at the primary operation.

The cystic obstruction frequently depends on a stone, which can be much better removed at this time than later. If the gall-bladder is very adherent to the omentum, colon, or other viscera, the adhesions are freed a sufficient space on the fundus for manipulation, and on the inner side to permit of careful exploration of the ducts and to facilitate the removal of stones.

No attempt has been made to free the adhesions at every point, as this would open up further avenues of infection and destroy temporary barriers of adhesions. If the cause of the cholecystitis is removed, the adhesions usually disappear in time, and if separated reform temporarily. Should the history indicate that these adhesions have been causing trouble, it would of course be best to divide them and cover the raw surface by suturing to prevent reformation.

It is a very frequent experience to find a contracted gall-bladder deep under the liver, which it is impossible to suture into the wound. In such cases we have found a very satisfactory method of drainage to be as follows:

Two or more long sutures of fine catgut are passed through the walls of the gall-bladder below the opening. A well of gauze strips two inches in width is now formed by passing one or more doubled thicknesses down just outside of the gall-bladder and tying in place with the catgut sutures. The side of a rubber drain is caught at a little distance from its extremity by one of the threads of catgut on a needle, and the tube is then passed into the gall-bladder and tied in place. This firmly anchors the drains in position and prevents displacement, the external incision is partly closed up to the drainage in the usual manner. The catgut is absorbed before it is necessary to remove the drains.

We have not hesitated to crush soft stones in the cystic duct with the fingers; but if the deposits are hard, the duct has

been opened by incision and the stone removed. The success of Mayo Robson in crushing stones impacted in the bile-ducts is encouraging, and probably could have been done with advantage in some of the cases in which cutting was resorted to.

The time of drainage of the gall-bladder has varied with the case, if one is certain that all stones have been removed, and the walls are not greatly thickened, nor adherent, and bile flows freely at once, three or four days is sufficient.

If there have been many small stones or much fragmentation of soft ones, a quantity of bile-sand, or evidence of prolonged inflammation, one or more weeks is necessary.

The suggestion of Knut Hoegh that suturing at a low point in the incision favors fistula-formation is probably true, as it does not properly elevate the fundus and should be avoided.

Of the eleven cases in which stones were removed from the common duct, in only four was an attempt made to suture the duct, in two of these there was no leakage. Seven cases were treated by drainage without suture, and the recovery was just as prompt as in the sutured cases. The stone is isolated and the duct held between the finger and thumb. By pressing the stone firmly against the duct wall and then relaxing it, veins can sometimes be located as they fill and avoided.

A longitudinal incision is made, and the stone caused to present, following the suggestion of Elliot, the stone is used like a stocking ball for the placing of a lateral suture of fine catgut each side of the opening, it is then removed and search made for others, which are removed, if found. A strip of gauze two inches wide is carried down each side of the opening and tied in place by the catgut. The edges of the incised duct are approximated with tissue forceps, and covered with several thicknesses of a third layer of gauze, and a rubber tube passed into the gauze well and fastened by one of the catgut threads. The gall-bladder is opened and drained in the usual manner, to prevent tension.

These cases are jaundiced, bleed easily, and withstand operation badly, suturing takes time, requires a large incision,

greater separation of adhesions, and more manipulation. In our experience it has proved unnecessary. W. E. B. Davis believes that it is actually harmful by not furnishing adequate drainage to the infected duct.

Cholecystectomy should be more frequently employed. Hans Kehr is emphatic on this point. It requires a larger incision and more manipulation, and, as performed, is a far more serious operation than cholecystotomy. It is often necessary as a secondary operation after the drainage of an infected gall-bladder, or after failure of cholecystotomy to cure from any cause.

Considering that the mucous membrane is the only part of the gall-bladder which gives rise to after-trouble, we have during the past year, in three cases, opened the gall-bladder and removed the mucous membrane to the cystic duct, at this point the mucosa is cut across part at a time and one or two bleeding points caught with forceps and tied, the duct being left open.

The muscular and peritoneal coats are sutured into the incision and drainage established in the usual manner. It is surprising how easily this can be accomplished. The mucous membrane is tough and separates from the muscular coats readily. The adhesions to the peritoneal coat are only separated enough to explore the ducts. It does not require a long incision, nor does it necessitate prolonged manipulation, and yet, the essential part has been removed to the same extent as in the usual cholecystectomy.

This modified operation adds little to the risks of an ordinary cholecystotomy.

[NOTE.—Since writing the preceding paper, the author has in two additional cases performed the modified cholecystectomy as detailed above. In one of these cases a stone impacted in the cystic duct was removed with the mucous membrane of the gall-bladder and duct to a point beyond the stone with perfect ease. A number of operations after this method have been made by several surgeons, to whose attention the writer had called it with equal success.]

OBSERVATIONS ON THE SURGICAL ANATOMY
AND METHODS OF CURE OF INGUINAL
HERNIÆ, PREFERABLE OPER-
ATIONS.

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IT must be remembered, at the onset, that the rings¹ and canal¹ are only potential. They do not exist as rings and canal in the normal condition. The rings are intimately blended with the structures that pass through and fill them. The external ring is an oblique slit in the external oblique aponeurosis, and under normal conditions will not admit, in addition to the cord or round ligament, the tip of the finger. The canal is a chink or an oblique slit in the thickness of the abdominal wall. It is flattened from above downward, and curves around the pelvic bone for the passage of the cord or round ligament, and the rings are also blended with the structures contained. It was once a canal, but for a time only,—*i.e.*, in the latter months of fœtal life,—and only a vestige of it remains in the normal adult. In very early life one ring lies directly behind the other, so as to facilitate the passage of the testis. In the adult it measures about an inch and one-half in length. Its obliquity is brought about by the growth of the bony pelvis. It extends from the external to the internal ring in the direction backward, slightly upward, and outward. In studying the inguinal canal,² in order to understand it, we must throw aside and avoid all such expressions as the anterior and posterior walls and the inner and outer borders of the canal, as they are useless and unnecessary terms that serve only to confuse and complicate the subject. The only boundaries that should be named are the floor and the roof, which are close together.

The floor is formed by the meeting of the transversalis fascia with Poupart's ligament; the roof by the union of the internal oblique and transversalis with Poupart's ligament, and the apposition of the conjoined tendon with Poupart's. The internal ring is merely a funnel-shaped expansion of the transversalis fascia, which the cord carries on as it escapes from the pelvic cavity. This expansion may be weakened, but it is never an opening except when made so artificially. When a hernia is present, the internal ring is enlarged, usually it is enlarged at its upper angle, as here it is weakest as the intra-abdominal pressure is greatest. However, it may be enlarged in any other direction, except at the lower angle, where dilatation is prevented by the unyielding pubic bone. When the internal ring is examined from inside the abdomen (after the removal of the peritoneum and the subserous fat), it appears as a crescentic edge, over which, close to the pubic bone, turns the cord.

When a protrusion is present, the upper angle of the internal ring is located midway between the anterior superior spine and the spine of the pubis, but it may reach the level of the anterior superior spine. It is oval in shape, with the long diameter upward and outward, its dimensions varying from half an inch or more according to the size to which it is dilated by a protrusion. The transversalis fascia in this region is stronger and more developed than in others, and consists in most cases of bundles of firm and almost tendinous fibres. A well-marked band passes along parallel with Poupart's ligament and spreads out towards the anterior superior spine. This is called the outward limb of the internal ring or the outer portion of the transversalis fascia. Another band of fibres like that just described proceeds from near the angle between the rectus and the pubis, turns upward as it approaches the internal ring, and forms its inner boundary. Some of these strong fibres can be traced as far as the fold of Douglas. This is the internal limb of the internal ring, or the inner portion of the transversalis fascia. On the deep surface of Gimbernat's ligament this fascia blends with the iliac fascia, and together, as

they turn around its free border, give the ligament a round edge. The transversalis fascia is best marked at its attachments to the deep portion of Poupart's ligament, to the ileopectineal line (Gimbernat's ligament beyond the conjoined tendon), where it descends towards the femoral vessels, and where it separates the transversalis muscle and the conjoined tendon from the peritoneum. After it passes under Poupart's ligament it unites with the iliac fascia to form the femoral sheath.³ The cord passes through the external ring and, entering the canal, runs obliquely backward and upward and outward to the internal ring, curves around the pubic bone, close to the ilio-pubic suture, and, entering the pelvis, passes downward and inward to the base of the bladder. Ninety-three per cent. of all inguinal herniæ are oblique,—*i.e.*, the hernial sac comes out of the internal ring, passes down and inward and forward along the canal to or through the external ring. The protrusion in oblique hernia, in passing through the abdominal wall, carries before it the peritoneum and the subserous fat, but tears asunder the borders of the internal ring, separates the internal oblique and the transversalis muscles in part of their attachment from Poupart's ligament, displaces the conjoined tendon to the inner side and Poupart's ligament to the outer, and separates the inner from the outer pillar of Poupart's ring. Seven per cent., or the balance, are direct or ventral hernias,—*i.e.*, the protrusion does not escape through the internal inguinal ring or canal, but either pushes before it the transversalis fascia and the thinned and imperfectly developed conjoined tendon, or passes directly through an opening in these structures on a level with and above the external ring.

In deciding on an operation for the cure of inguinal hernia,² the problem is to restore the structures durably to their normal positions, relations, and uses. Keeping this, the true solution, clearly before us, we have the key to the situation. I believe, if these fundamental principles are adhered to in operating on our cases of hernia, that in the immense majority of cases the patients will be permanently cured. The operative treatment of hernia is regarded by some with slight disfavor.

This I can say is due to the bad results obtained by those surgeons whose technique is imperfect, or whose operations are incomplete or illogical and unscientific. Sepsis, inexperience, or carelessness is the explanation of all surgical accidents, and I am sure that if an aseptic wound becomes infected, every possible antiseptic and aseptic precaution has not been carried out. In earlier papers⁴ I reported eighty-five operative cases of inguinal hernia, gave an analysis of the cases, the methods employed, and the results obtained. I stated that an operation to be followed by a permanent cure should fulfil the following conditions: (1) Cause total obliteration of the sac. (2) Allow for the safe transmission of the cord and its structure,—*i.e.*, the cord should not be subject to pressure in any part of its course, and the operation should not be followed by pain, thickening, or inflammation, etc., of the cord, or in any other manner interfere with its functions. (3) Not result in inflammation, atrophy, sloughing, etc., of the testicle. (4) Close durably the breach in the abdominal wall.

I then described an operation⁵ which I considered fulfilled these indications, and overcame the objections to all the other methods of operation hitherto described. Briefly the steps of the operation are as follows:

An incision is made parallel with, and one-half an inch above, Poupart's ligament from the external ring to one-half an inch above the upper angle of the dilated internal ring, dividing the skin, subcutaneous tissues, and the external oblique aponeurosis. The latter is lifted with forceps and freed from the structures beneath, till the outer border of the rectus and the shelving edges of Poupart's ligament are clearly seen. The sac is isolated, opened, and the contents cleared out, removing all omentum that protrudes and can be drawn down into the internal ring and canal. In removing omentum it is perfectly safe and best to ligate the vessels only. To insure the ligatures from slipping use the fixation ligature. The vessels to be tied are defined by spreading out the omentum, and a curved needle carrying fine chromicized catgut is passed around the artery or vein by piercing the tissues of the omentum im-

mediately surrounding the vessel. The ligature is then tied in a reef-knot, and the vessel and other structures forming the omentum are severed beyond the ligature. All other vessels are similarly treated and omentum cut away. All adhesions internally and externally to the sac are separated. Next, the sac, its neck, and, as high as possible, the peritoneum continuous with it, are removed, and the cut edges of the serosa drawn down with forceps are closed with continuous sutures. Usually one and a half inches or more of the peritoneum above the neck of the sac can be drawn down with forceps and removed. When released, the sutured edges of the serosa retract high up within the abdomen away from the internal ring, etc. The rings and canal are cleared of all masses of fat, glands, and adhesions, and all such masses that bulge into the internal ring from the subperitoneal tissue are also removed. Any markedly varicose veins of the cord are excised high up within the internal ring. Retract with forceps and retractors the internal oblique and transversalis muscles, the conjoined tendon, and the cut edges of the external oblique aponeurosis. The dilated internal ring is sutured. As a rule, the inner and outer borders of the internal ring have to be lifted with forceps when the sutures are inserted, in order to introduce them neatly and accurately. The inner border is always brought well into view by firmly retracting with forceps the internal oblique and transversalis muscles and their conjoined tendon. In some cases the outer border of the internal ring or the outer limb of the fascia is dilated. In these, by piercing this portion of the fascia with the needle and sutures at some distance from its edge, sufficient fibrous tissue, etc., can be gathered together by the sutures which collect the relaxed tissues into a bundle, which, with the plastic exudate that is thrown out around the sutures, makes the fascia firm and durable. Commencing at the upper angle, bring the inner and outer borders of the transversalis fascia accurately together with continuous sutures, leaving only sufficient room at the lower angle close to the pubic bone for the cord. The internal ring is reinforced and the canal closed by uniting with continuous or interrupted sutures the internal

oblique and the transversalis and their conjoined tendon (and sometimes the edge of the rectus muscles) to the shelving edge of Poupart's ligament, leaving only room enough next to the pubic bone for the cord. Suture the cut edges of the external oblique, and the pillars of the external ring which are made to snugly embrace the cord. When the deep layer of the superficial fascia is well developed, unite its cut edges with a separate layer of continuous sutures. Finally, the cut edges of the skin are closed without drainage.

In women the operation is the same as in the male, with the exception that there is the round ligament to deal with instead of the cord. The round ligament is disturbed as little as possible. In fact, little or no attention is paid to the round ligament. The sac, etc., are removed, taking care to avoid injury to the round ligament.

(1) The cut edges of peritoneum are sutured; (2) the internal ring is sutured; (3) the internal ring is reinforced and canal closed by suturing the internal oblique and transversalis muscles and their conjoined tendon (sometimes the edge of the rectus muscle) to Poupart's ligament by a row of stitches; (4) the cut edges of the external oblique aponeurosis and the pillars of the external ring are sutured; (5) finally, the skin is closed with fine sutures without drainage.

In direct hernia, when the protrusion pushes before it the transversalis fascia and the thinned and imperfectly developed conjoined tendon, the same operation as described above in detail is used, with the addition that the layer of sutures that reinforces the internal ring and closes the canal also always includes the edge of the rectus muscle. The needle and sutures, by including the edge of the rectus, gather together the relaxed and stretched structures of the conjoined tendon into a bundle of tissues which, with the reparative changes that take place, together with the plastic exudate that is thrown out around the stitches, makes the structures firm and durable. In the other cases of direct hernia, where the protrusion passes through an opening in the transversalis fascia and the conjoined tendon, an incision is made as for oblique hernia, di-

viding the skin, subcutaneous tissues, and external oblique aponeurosis in the direction of its fibres. The latter is lifted and freed, exposing well the opening in the transversalis fascia and the conjoined tendon. The sac is isolated and treated as already described, and the cut edges of the peritoneum united with continuous sutures. The separated edges of the transversalis fascia are brought accurately together with continuous sutures. The separated edges of the internal oblique and transversalis and their conjoined tendon are united. The needle and stitches on the inner side also include the edge of the rectus. Suture the cut edges of the aponeurosis of the external oblique and the pillars of the external ring which are made to snugly embrace the cord. Finally, the cut edges of the skin are closed without drainage.

Dressings, etc.—Sterilized gauze held firmly in place by long strips of adhesive plaster, then a layer of cotton and firm spica bandages. Dress the wound on the seventh day, or earlier if there are indications. Apply dressing, etc., as before, and keep the patient in bed two weeks or longer, if possible. If primary union is not obtained, do not allow the patient out of bed until cicatrization is complete. The firm dressings and bandages are removed one month after the operation, when the patient is allowed to go without any pad or truss.

Some Points in Technique.—When the adhesions between the sac and cord are firm, it is advisable to open the sac first. This saves time, as the limitations of the sac can be more readily defined and the adhesion more easily and quickly separated. The sac in congenital inguinal hernia requires special treatment. This form of hernia is rare in adults. The sac in this form, being continuous with the tunica vaginalis testis, cannot be dissected out and removed in its entirety, hence it should be separated from the surrounding structures, and then divided transversely above the testicle, care being taken to avoid injury of the cord. The lower half is dealt with first. The excess of the tunica vaginalis is trimmed away and the cut edges united with continuous sutures of fine catgut. Sufficient of the tunic should be left to allow of the free move-

ment of the testicle, then the upper portion of the sac, its neck, and as high as possible, the peritoneum continuous with it, are removed, and the cut edges of the serosa united with continuous fine catgut sutures, as I have described in other forms of the hernia. This was the method used with the sac in a case I have operated upon in October, 1896, of a man aged thirty-one years.

During omental excision, by ligating vessels only in the omentum and using fixation ligatures, the ligatures are fixed in the omentum and cannot slip. It is unnecessary and absolutely unsurgical to ligate the fatty tissues of the omentum. By ligating the vessels only the work is easy, safe, and æsthetic, and it does away with numerous and mass ligatures, lumps of fat constricted by ligatures, omental stumps, non-absorbable, dead, and wandering ligatures, adhesions, sloughing, omental inflammation, local and general peritonitis, and secondary operations for the removal of the omental stumps and adhesions, etc. In closing the different layers separately and accurately continuous sutures should be employed, using three or four stitches to the inch.

The most suitable continuous stitch at present in use is the continuous single knot stitch, as described by C. Ford.⁶ For practical purposes about every eighth stitch should be tied with a reef-knot. In order that it does not untie and that no cut ends are left to irritate the wound, the knot should be tied without cutting the thread. This can be done by using the continuous double-knot stitch.⁶ With continuous stitches the work is done quickly, the coaptation is excellent, as the whole of the opposed surfaces are brought together, the circulation at the united edges is good, the tension is adjusted satisfactorily, and the knots are so few in number that they do no harm, in fact, offer some advantages.

Interrupted stitches, or continuous reef or other double-knot stitches, should be avoided, as they are tedious and slow. The excessive number of knots, when the stitches are buried, are local irritants, and may delay union. Extra time is taken in adjusting, tying, and regulating the tension of the knots.

The threads are slippery, may become tangled, and complicated manœuvres are required to insert and tie them.

If interrupted stitches are used as buried sutures, the cut ends are points of irritation. The knots are liable to untie if the ends are cut short, and if left long, they increase irritation. Mattress stitches should not be used either buried or cutaneously, as the edges are not accurately and completely approximated. From their method of insertion the plane of force is changed, coaptation of the opposed surface is along only a line of the edges, the superficial edges evert on account of the curvature of the plane of force, and consequently there is imperfect approximation. The spaces between the stitches are not supported. The necessity of reversing one's movements while suturing renders the mattress stitch slow of insertion. The cobbler's stitch or, as Marcy¹¹ called it, the double continuous stitch should also be avoided. It is slow, tedious, cumbersome, and crude. Tension cannot be well adjusted. The changing of needles and of directions of passing the sutures make needless work. There is also marked interference with the circulation along the line of union on account of the method of insertion of the stitches. For passing buried stitches we should use needles that can be quickly threaded, easily handled without a holder, and that readily penetrate the tissue without contusion or producing hæmorrhage. I find that a moderately fine, curved Hagedorn needle, about two and a half inches long, with the curve corresponding to the quarter of a circle, answers best.

In fat patients a needle with the curve corresponding to the half of a circle should be used for the deeper layers. A very fine, straight Hagedorn is best for the skin. After inserting the sutures, the stitches must not be drawn tightly, on account of the danger of compression anæmia and subsequent sloughing, which would interfere with perfect repair in structures that need great care on the part of the operator. In closing the skin and fatty layers, the needle and sutures include the whole thickness of the skin, but no fat. If any fat is taken up in the stitches it will subsequently give way under the press-

ure, and fat necrosis result with the discharge of fluid, etc., from the wound, which would cause delayed healing; the sutures being loosened, the margins of the skin drawn apart a trifle, and the scar is flattened out into a broad line within a few weeks, and remains permanently as a scar. Fatty layers can be approximated by manual pressure applied on the outside of the wound, and after the skin sutures are tied, the cut fatty layers remain in contact by atmospheric pressure.¹² To make sure of a very fine scar leave the silk sutures in ten days or longer, if there is no irritation. Afterwards apply freely to the line of union and beyond it collodion, which prevents stretching of the scar-line.

Primary, firm, and durable union should be regarded of first importance in our operations, hence the buried suture and ligature materials are of prime importance. Many failures in hernia cases are due to the use of sutures,—*e.g.*, ordinary catgut and tendon, that are absorbed before the union is firm and durable; to the use of non-absorbable sutures; or not suturing each of the layers separately and thus accurately. The structures dealt with in hernia operations are in the main tendinous and fibrous, requiring several weeks for durable union. Non-absorbable materials—*e.g.*, silk, wire, silkworm gut, etc.—should not be used as buried sutures and ligatures, as they all, at times, even when the wounds heal by primary union, act as foreign bodies, work their way to the surface, and form slow-healing, painful, and troublesome sinuses. Cases have been observed in which patients have been incapacitated for weeks and months⁷ on account of sinus-formation. At times repeated operations have to be done to remove the ligatures or sutures, and still later, second operations to cure the hernia. In earlier articles⁸ I reported cases in which sinuses formed following the employment of silk, silver wire, and worm-gut as buried sutures.

In addition, I reported one case in which sinuses formed following the use of too heavy chromicized catgut, since then I have seen several such cases. Chromicized tendon is the most suitable material for a buried suture, as it is non-irri-

tating, and when well chromicized is not absorbed for two or three months, when it is replaced by fibrous tissue. Busse⁹ in his experiments showed that perfect tendinous union does not occur under ten weeks, or just about the period required for the absorption of chromicized tendon.

In the absence of tendons, chromicized catgut should be used as buried sutures. Marcy¹¹ maintains that kangaroo tendons, if properly chromicized, are very resistant, and that they remain in the tissues for three months before they are absorbed. The writer has seen kangaroo tendons, supposed to be properly chromicized, that were absorbed in about eight days. To ligate vessels and close the peritoneum I use fine chromicized catgut,¹⁰ for the skin fine chromicized catgut or silk.¹⁰

During the past few years many methods of operation have been described and used for the cure of inguinal hernia. At the present time one sees this surgeon using an incomplete method; that surgeon an operation involving the principles of cicatricial tissue forming a barrier; another introducing extraneous materials—*e.g.*, loops of wire, wire fences, non-absorbable sutures, bone-plugs, etc.—into the rings of the canal; another displacing and disarranging the structures; and still another, an operation involving the principles of restoring the structures durably to their normal positions and uses. Reviewing these operations the question arises, Which is the best to adopt? We can only arrive at the very best conclusions on this matter by reviewing these several methods of operation, keeping in mind the point to determine the choice which fulfils all the indications for a permanent cure. In the article on the treatment of inguinal hernia, in "Dennis's System of Surgery," vol. iv, published in 1896, the authors, Drs. Bull and Coley, stated that the principles upon which modern operations for inguinal hernia are based are the following: (1) Simple ligation of the sac and extirpation (Socin); (2) ligation of the sac and suture of canal (Czerny, Banks, Baker, Championnière, McCormac); (3) infolding of the sac and suture canal (Macewen); (4) torsion of the sac in canal (Ball); (5) torsion of the sac and suture of canal, with the

sac external to the aponeurosis of the external oblique (Kocher); (6) high ligation of the sac and suture of canal after displacement of the cord (Bassini, Marcy, Halsted); (7) high ligation of the sac and closure of the canal by cicatricial plug, the wound being allowed to heal by granulation (McBurney). To these I add the method I have described, the principles of which are: (8) (*a*) supercorrection of the peritoneum by removing the sac, its neck, and, as high as possible, the peritoneum continuous with it, and closure of the cut edges of the serosa with continuous sutures; (*b*) suture of the internal ring, placing the cord close to the pubic bone; (*c*) reinforcement of the internal ring and closure of the canal by uniting the contiguous muscles and their conjoined tendon to Poupart's ligament; (*d*) suture of pillars of the external ring.

I shall review the following operations: Bassini's, Halsted's, Macewen's, Kocher's, Nélaton and Ombredanne's, Fowler's, and the operation I have described, and in so doing the advantages and objections to the other methods not reviewed will be clearly shown. Bassini's and Halsted's methods are so nearly identical that they may be taken together. Bassini displaces the cord to the upper angle of the dilated internal ring, near the anterior superior spine, the cord finding its way down beneath the external oblique aponeurosis, between the two layers of buried sutures, while Halsted displaces the cord two centimetres farther out, nearer the anterior superior spine, between the edges of freshly cut muscular layers, the cord finding its way down beneath the skin between the layer of buried and skin sutures. Halsted also excises in the canal what he designates as superfluous veins of the cord. In both these operations the spermatic cord, through being displaced, is shortened and on the stretch; from its new relations, it is subject to pressure, muscular contraction, and the liability of adhesions to surrounding structures from the new internal to the new external ring; thus the functions of the nerves and vessels of the cord and the cord proper are interfered with, and following these operations there may be thickening, swelling, tenderness, or inflammation of the cord; and swelling, in-

flammation, sloughing or atrophy of the testicle. Thickening and swelling of the cord I have frequently seen follow the Bassini operation. The spermatic cord is put on such a stretch that it is subject to the continuous traction of the bladder on the one hand and the testicle on the other, and there is no doubt with this traction, aided by gravitation, that the cord will find its way back to its normal position. The higher the cord is transplanted and the internal ring displaced, the nearer they are to parietal peritoneum, intestine, omentum, etc., and thus relapse is favored. Disturbances of the bladder, scrotum, etc., follow these operations. No immediate and very little remote benefit is derived by excision of veins of the cord in the canal, as this does not materially reduce the size of the cord at the internal ring, where the breach first occurs. The neck of the sac should not be tied off. The ligature is liable to slip, and in tying the knots a piece of omentum or bowel is liable to be included, giving rise to adhesion, obstruction, etc. Ligation also leaves a pouch in the peritoneum and causes puckering of the serosa, which favors the formation of adhesions between the parietal and visceral layers. A single layer of buried sutures, or two layers with the cord interposed, is objectionable. The edges of the different layers, not being brought accurately together, overlap, become irregularly matted together and adherent to one another, and thus the union which results is liable to be weak and evanescent. Halsted has more relapses than Bassini. This is easily explained, as the former displaces the cord higher and uses one layer of buried sutures, while the latter uses two layers of buried sutures; the deeper forms a wall, while the other is an additional barrier.

Duplay and Cazin¹³ try to realize Bassini's operation without buried sutures. The sac is dissected out, and whenever possible it is knotted several times upon itself. The cord is isolated. First a silver cord is passed through the skin two centimetres below the edges of the lower lip of the incision, through the underlying soft parts, Poupart's ligament, across the base of the wound through the whole thickness of the

muscular tissue. The same wire is curved in U-shape, and is then carried in an opposite direction successively through the different layers which it had already gone through, and it finally issues through the skin two centimetres below the lower lip of the skin incision, the point of exit being about eight millimetres from the point of entrance. Two or three U-shaped wires are usually inserted. When the cord has been put back in place, five or six wires are passed through the skin incision, comprising successively also from below upward the pillars of the external ring and the cut edges of the aponeurosis, external oblique that was slit upward early in the operation. The deep wires are now twisted. Ascertain with the finger that the coaptation is perfect, then twist the loops of wire with forceps until this result is secured. Next tighten the superficial sutures which coapt the cut aponeurosis, the pillars of the external ring, and the skin incision. A few very fine wire sutures are also often necessary to bring the skin incision well together. Superficial sutures are removed after eight days have elapsed, and the deep sutures are left in from twelve to fourteen days. W. B. Coley has operated upon thirteen cases of inguinal hernia wherein the technique of the operation was practically the same as Bassini's without the transplantation of the cord. Of these thirteen, eleven were traced and four had relapsed. (In Keating's "Cyclopædia on the Diseases of Children," Vol. v, p. 702, of Supplement edited by Dr. Edwards, published January, 1899.)

Mattress stitches (Championnière, Macewen, Halsted, etc.), whether buried or otherwise, should be avoided, as has already been pointed out earlier in the paper, as they do not coapt accurately and evenly the whole broad surface of the edges to be approximated. Approximation is imperfect, as it is along simply a line of the cut edges. This is due to the manner in which the stitches are inserted and the direction in which they pull. Two layers of sutures (not buried) of silver wire or other material should be avoided, as the edges of the different layers are not brought accurately together, but overlap or underlap, become irregularly matted together and adhere to

one another, and thus the union that results is liable to be weak and evanescent. Wire sutures should be avoided in hernia operations, as they cut and irritate the tissues and have to be removed before the union is firm and durable. The use of these sutures also shows great imperfections in the surgical technique of the operators employing them, as in all probability their results from absorbable sutures have been unsatisfactory, owing to either imperfect methods of sterilization or imperfect technique or both.

The following reports bear out the objections I have stated to these or other somewhat similar operations. Halsted¹⁴ reports atrophy of the testicle in three of his cases following his operation; W. B. Coley¹⁵ reports a case of orchitis which terminated in suppuration, and required incision following a Bassini operation.

W. B. DeGarmo¹⁶ showed six cases operated upon by the Bassini method, and in giving their histories, etc., stated that in the first case shown "there were no adhesions in the sac; forty-eight hours after the operation the patient was passing but little urine. The bladder was much disturbed, a trochar was introduced, and with difficulty thirty-six ounces of urine were drawn off. Later Eugene Fuller *opened the bladder through the perineum and introduced* a tube, which was kept in ten days." In the second, "a double inguinal hernia, the patient had a marked cedema of the scrotum on the right side. I have shown this case to you, because it is not fair to show all cases that are good and not the bad." In the third, "after the operation, there was an enormous cedema of the scrotum and penis. There is still some enlargement of the testicle, and he will have to wear a suspensory on account of it." In the sixth case shown, "the testicle was at the external ring, the cord was made shorter by the Bassini operation, and the testicle sloughed off, and another operation had to be done for its removal." G. M. Brewer,¹⁷ in a report of "the condition of the parts found upon autopsy, six weeks after a Bassini operation," stated that "a certain amount of induration was felt for some time over the course of the spermatic cord extending to the

testicle. This, however, was not specially tender to the touch. The portion of the peritoneum lining the inguinal region showed a slight puckering. The vas deferens, spermatic artery, and a number of veins were traced upward through the artificially made internal ring and downward into the scrotum, becoming more united and apparently bound together as they approached the testicle."

Bishop¹⁸ stated that "after the Bassini operation, even when the tissues have gained their firmness, the inner extremity of the internal ring is in a direct line with the outer extremity; that there was no protection whatever against ventral hernia at the new point at which the cord made its exit from the abdomen, and that a relapse is a relapse, by whatever name the new hernia may be known."

Tailleus¹⁹ comments on 324 cases in the service of Professor Doux, in the years 1890 to 1894 inclusive, and reports that at first silk was employed, later catgut; seventy-four recurred; of 288 inguinal hernias 16.7 per cent. recurred. Bassini's operation was less successful than that of simple suture, giving nearly 36 per cent. of recurrences, as against a little over 12 per cent. by the last-named procedure (ligature and excision of the sac, a single layer of sutures through the external oblique, and some fibres of the internal oblique); suppuration occurred frequently, particularly in inguinal hernias. Of the 324 cases, 257 healed by first intention, 15.2 per cent. of recurrence of primary-union cases; 22.4 per cent. of recurrence in suppuration cases. Suppuration was more frequent after Bassini's operation than that of simple suture. Of 288 cases of inguinal herina there was atrophy of the testicle in twelve, hydrocele of the cord and testicle in three, varicocele in three. The atrophy was more frequent after Bassini's operation.

S. C. Gordon stated that²⁰ "he had seen more or less swelling of the testicle in all operations done by both the Bassini and Halsted methods." In describing a case he states, "I feared if I did the Bassini operation it would press too hard on the cord." The Bassini operation was not performed, and

“the patient recovered with no discomfort from these usual complications.”

I have notes of a case operated upon by Halsted's method. The patient, a male nurse, was admitted to the New York Post-Graduate Hospital with a mild attack of urethritis and orchitis, while I was house-surgeon. Examination showed a marked recurrence of the hernia, and on the same side the cord thickened and tender, the testicle enlarged and painful. The cord and testicle on the other side were normal, and did not subsequently become involved. Under treatment the urethritis got well, and the pain and most of the tenderness in the testicle subsided; but when he was discharged from the hospital there was a marked thickening of the cord and enlargement of the testicle.

This is not a detailed report from all the literature of the day, nor have I written operators for reports of their cases. I do not think this necessary, as the cases I have cited are sufficient in themselves to show that the principles of these methods, like McBurney's and those operations in which extraneous materials are introduced, are false in theory and no longer justifiable in practice. When relapse does occur, there are associated, at times, such deplorable symptoms that no truss can be worn with any degree of comfort. A possibly cured rupture, an enlarged, thickened, and adherent cord, and a hypertrophied or atrophied testicle are a most lamentable combination.

The last case I operated upon by Bassini's method was in September, 1894; since then I have employed the method described and recommended in this paper.

The methods of Kocher and Macewen are sometimes used, but they are both open to so many objections that they are not used frequently at the present time. Both these methods are incomplete, as the canal and rings are not exposed, and the methods of suturing are incomplete and imperfect. Kocher himself states that his method can only be used when the sac is not too large, or its walls too thick. In Kocher's operation the aponeurosis and the other structures are bruised

during the manipulations of the sac, and by working through a small slit in the aponeurosis a great deal of damage is done to all the structures. The sac in any hernia operation should not be twisted, tied off, or anchored superficially to the aponeurosis, or at any other place. The sac should not be infolded and anchored at a plug in the canal and internal ring, or at any other place. I have already stated the objections to tying off the sac. Twisting has the same objections, and, in addition, as Kocher himself states, it is liable to cause sloughing. Anchoring the sac, by fixing its neck, forms a cone in the peritoneum into which bowel, omentum, etc., slip, and the cone by the constant pressure of a protrusion from behind and within is converted into a wedge which will be likely to reopen the rings and canal, and be followed by a relapse of the protrusion. The infolding of the sac into a pad or truss, which is placed in the canal and internal ring, favors relapse. Pathologic material which has been thrown off is returned to the abdomen. The sac should always be opened and inspected, as often omentum is adhered to the interior and sometimes also intestine. Returning the sac unopened is not only dangerous on account of intestinal and omental adhesion, but also for many reasons it disposes to relapse. A pad or truss making pressure over the internal ring from the outside is very seldom curative in adults, and is bad enough; but a pad or truss in the canal and the internal ring is worse, as it serves to keep the rings and the canal open, and being acted upon by the pressure of the diaphragm, transmitted through the intra-abdominal contents, acts as a wedge, which, by still further opening the rings and canal, favors a relapse of the protrusion. Bishop²¹ reports sloughing of the infolded sac following Macewen's method. In both of these methods the suturing of the rings and canal is incomplete. In fact, neither of these operations fulfils the indications for a cure, as none of the strictures are returned to their normal positions. The chief reasons for failures in operations for hernia have been due to the efforts of surgeons in not repairing and restoring the structures to their normal positions, relations and uses, but by the illogical and unscientific

introduction of extraneous material, the displacement or disarrangement of structures attempt to improve on nature.

In Nélaton and Ombredanne's method the transversalis fascia is divided from the upper border of the pubis to the internal ring. A button of bone is removed with a punch from the os pubis, about one-third of an inch below the superior surface. A chain-saw is carried through the opening, the roof of the bone is divided, and the bridge lifted with powerful forceps, the periosteal hinge at the outer side being left intact. The cord is placed in this opening in the pubic bone, the roof is dropped in place and sutured with catgut, and the deeper layer of the abdominal wall is sutured with a continuous suture passing from the conjoined tendon to Poupart's ligament; with the same form of suture the superficial layer is closed from below upward. If signs of pressure of the cord are noted,—*e.g.*, varicocele, œdema, etc., of the cord,—the wound should be opened, the roof of the osseous canal lifted, the floor of the bony canal cut out, and the cord dropped below the pubic bone. This method is open to the serious objections of the other operations wherein the cord is displaced; besides, it has additional serious objections. Any osteoplastic operation should not even be considered, as it is dangerous and unnecessary. The punch, chain-saw, powerful forceps, etc., increase the gravity of the operation, and may do irreparable damage. It is dangerous and at times impossible for the needles and sutures to approximate the divided edges of the periosteum. Catgut is not sufficiently durable to hold the periosteal edges together long enough for firm union. Osteoplastic operations should be avoided as better results can be obtained by the writer's simple method, which is also a safeguard against secondary operations.

In Fowler's²³ method a curved incision of the skin and subcutaneous tissues is used, the deep epigastric artery and vein are sought for, exposed, ligated in two places, and divided between the ligatures. The peritoneum, the subperitoneal connective tissue, and the transversalis fascia are divided with scissors. A portion of the cord is pushed into the peritoneal

cavity and the cut edges of the peritoneum are drawn forward. Through-and-through sutures are passed from side to side. Suturing is begun at the upper angle of the wound. Leave an opening at the lower angle for the emergence of the cord. The inguinal canal, the gap in the aponeurosis of the external oblique, and the skin are now closed. Kangaroo tendons should be used for the deep sutures. Fowler's method has all the disadvantages of the other operation wherein the cord is displaced. Displacing a portion of the cord within the peritoneal cavity makes in the serosa two unnecessary openings which are very liable also to allow of the passage of omentum, intestine, etc., thus giving rise to pain, adhesions, intestinal obstruction, etc. The displaced cord also anchors the peritoneum in the inguinal region, forms a cone of the serosa into which the bowel and omentum slip, and the cone with the traction of the cord from below and the pressure of the protrusion from behind and within is converted into a wedge which will be likely to reopen the rings and canal, and be followed by a relapse of the hernia. The incising of the peritoneum and the subserous connective tissues, etc., opens unnecessarily additional serosa, etc. Cutting these structures in the depths may seriously injure intraperitoneal and other structures. The division of what is erroneously called the posterior wall of the canal, or what should be properly called the floor of the canal, is a purely theoretical part of the operation, as the amount of tissue severed is very small in amount,—*i.e.*, the portion of the transversalis fascia that forms the internal ring,—when examined from inside the abdomen (after the removal of the peritoneum and subserous fat), appears as a crescentic edge, over which, close to the pubic bone, at the ilio-pubic suture, curves the cord, under which the transversalis fascia meets and unites with Poupart's ligament to form the floor of the canal. (See "Surgical Anatomy.") Thus the incising of the transversalis fascia offers every disadvantage. The divided fascia, though small in amount, when healed, forms scar-tissue, which presses upon and interferes with functions of the cord and its vessels, etc., producing thickening of the cord with the prob-

able atrophy, etc., of the testis. Through-and-through sutures should not be used in hernia operations, as they do not bring the edges of the different layers accurately together. To locate and ligate the deep epigastric vessels is a waste of time and absolutely unnecessary, and, furthermore, exposes the patient to the danger of hæmorrhage. There is not the slightest danger of injuring these vessels if the surgeon follows his landmarks carefully. The curved incision of the skin and subcutaneous tissues should be avoided as it offers disadvantages, is not as neat and clean a cut as the normal straight incision, does not expose as well the deeper structures, the flap is always in the way, and thus the edges are more difficult to approximate and suture. Sloughing and stitch irritation are liable to be complications. After the wound has healed, on account of its location, etc., the curved scar is liable to be painful, unsightly, and stretch, as it does not follow the normal creases of the groin.

Now as to the operation I have described, and used with every advantage. The lifting and freeing of the external oblique aponeurosis exposes well the deeper structures, which, later on, by this free dissection, are brought accurately together, without tension, to close the gap in the abdominal wall. Supercorrection of the peritoneum at the dilated internal ring causes total obliteration of the sac, strengthens the serosa by converting its outer surface from a convex to a slightly concave one, carries the former location of the sac high up within the abdomen away from the internal ring and the cord, and leaves a smooth surface, which allows of the free movement of the intestines over its surface. It is better to over-correct, as the peritoneum may relapse a little, which carries it back to the normal condition. Very seldom will it be necessary to excise the veins of the cord. I have frequently met with enlarged veins which, after the removal of the sac, etc., in a short time resume their normal size. When there is a markedly varicose condition of these veins their excision, when performed high up within the internal ring, is followed by good results, as this reduces the size of the cord above the internal ring and canal,

both of which on this account can be made a little smaller. The clearing out of the rings and canal of masses of fat, glands, adhesions, and the removal of all such masses that bulge into the internal ring from the subserous tissues, removes material which would favor relapse by keeping the rings and canal open. Placing the spermatic cord at the lower angle of the internal ring close to the pubic bone restores it to the normal position, where it is not subject to pressure or in any other manner interfered with. It hugs the pubic bone, whence it passes downward and inward to the base of the bladder. It is absolutely unnecessary to form a new internal ring. The suturing of the enlarged ring, as I have described, restores it to the normal size. The lower the internal ring is placed, the farther it is away from the parietal peritoneum, intestine, omentum, etc., and thus not likely to favor a relapse of the protrusion. The closure of the internal ring is the most important step of the operation, most of the success depending upon the accurate suturing of this opening in the transversalis fascia, as it is here that the breach first occurs. This layer of sutures forms a wall, while the other layers of sutures reinforce it and form additional barriers against a relapse. The layers are sutured separately, as it is by this means alone that they can be accurately approximated, and thus firm and lasting union results. The operator aims to build the new wall as thick as possible. This operation is adapted for all cases of oblique and direct inguinal hernia, except those cases of direct hernia where the protrusion passes through an opening in the transversalis fascia and the conjoined tendon. For this class of direct hernia I have described an operation which results in radical cure.

This operation I have used in fourteen cases, dating to October, 1898, 1 was seven years old, 3 between ten and fifteen years, 5 patients between thirty and forty, 3 between fifty and fifty-five, 1 was sixty-five, while another was seventy. In my last ten cases I used with advantage, in dealing with the sac, what I call "supercorrecting the peritoneum at the internal ring."²⁴ I do not report the cases I have operated upon since

October, 1898. While they all recovered and none have relapsed, yet they are too recent. I report fourteen cases to explain the points of technique, etc., and results of the operations. More cases are unnecessary, as the reports of several are as instructive as a million, for the technique is the same in all.

So far the results are interesting, as they show how easily the steps of the operation can be carried out, how well the wounds have healed, and how well the operation fulfils all the indications and overcomes the objections to all other methods. In every case the steps of the operation were easily performed.

In one case, operated upon by Dr. Dudley Tait and myself, the surgical dresser in the hospital ward removed the dressing from the wound on the third day after the operation. Fine catgut had been used as a skin-suture. In removing the adhesive strips he tore open the skin-wound by pulling the cut ends of the strips from, instead of towards, the edges of the wound. The final result will not be marred by this mishap.

In a strangulated intestinal herina I operated upon, Dr. G. Gross and I had an opportunity of making a post-mortem examination four days after the operation. The history of the case presented several points of interest.

The patient, W. O. W., aged seventy, had an inguinal hernia on the right side. Since 1885 he had worn a truss, which lately failed to do its work. The rupture came down twice during the first week in June, 1896, and was reduced on both occasions by a physician, the second time on June 5, but the pain in the abdomen continued, and, as it became more severe, bilious vomiting set in. As the intestine was apparently reduced, and the patient had at other times had bilious attacks and abdominal distress, he was treated by his physician for biliousness, but without relief. A consultation was called, but, notwithstanding the treatment given, the patient became worse. On June 7 the vomited material was of a greenish-brown color, and next day it was brownish and foul. Dr. Gross and I were called in and met the other physicians in consultation. Nothing could be made out by ordinary palpation of the inguinal region, but by bimanual palpation, the index-finger of one hand inserted into the canal through the external ring and making pressure externally with

the fingers of the other hand, I clearly demonstrated by forcing gas, etc., out of the strangulated mass that a knuckle of bowel was caught at the internal ring. Diagnosis of strangulation at the internal ring was then made. All agreed on operation at once. Assisted by Dr. Gross, I performed operation, which showed the sac at the internal ring the size of a small pear. It was full and tense, and when opened some blood-stained fluid escaped. At the internal ring was a loop of small intestine constricted by a firm fibrous band one-third inch wide; the constricted loop was purple, but had not lost its lustre. There was no gangrene, and no necrotic spots on the bowel or at or above the constriction, which was divided. When the intestine was drawn down, a large quantity of pale-yellow serum escaped from the abdominal cavity. The circulation gradually returned to the bowel. An enlarged gland, the size of a hickory-nut, which bulged into the internal ring from the subserous tissue, was removed. The sac was dealt with, and the other steps of the operation carried out, as I have described in detail elsewhere. Operation was not followed by shock; the pulse was 98, and fairly strong, and there was no vomiting. Two hours afterwards the pulse was 84, full and strong; rectal temperature 99.6° F. The patient complained of gas-pain, but could not expel any gas, even with a rectal tube. At 11 P.M. (seven hours after the operation) the pulse was 84, rectal temperature 98.2°, the abdomen slightly distended; no gas had been expelled, so a small enema was ordered; the bowels moved, considerable gas was expelled, and urine passed. On the following day the pulse was 80, rectal temperature 99.8°, the patient had vomited once; no gas had been expelled since 3 A.M., the abdomen was moderately distended. Another small enema was given, the bowels moved, and some gas was expelled; then by catheterization one and a half pints of urine were drawn off. On account of distention persisting, calomel, one-sixth grain, with sodium bicarbonate, three grains, was ordered every hour for six doses. At 10 P.M. the pulse was 86, rectal temperature 101.2°, the abdomen more distended. June 10, at 7 A.M., temperature was 101.8°, the pulse 105; at 4 P.M. the pulse was 104, temperature was 102.2°; at 9.30 an enema was given, and some gas was expelled. On June 11, pulse was 128, temperature 103.6°; the patient died at 6.10 P.M., with a rectal temperature of 103.6°.

The autopsy was made by Dr. Gross and myself at 9 A.M., June 12. There was no redness or other evidence of inflammation in any of the sutured layers; the abdomen was distended, and there was no fluid in the peritoneal cavity. Palpation of the inguinal and scrotal regions showed the cord and testicle to be normal. Firm pressure gave no evidence of weakness of the abdominal wall. The skin-edges were united. We were surprised at the degree of union present in the other layers. The skin was not adherent to the aponeurosis. The edges of each of the sutured layers were united with fresh plastic lymph, which also covered the sutures. The edges of the peritoneum were smoothly united, and located up in the abdomen away from the internal ring. The cord was freely movable. The bladder, kidneys, and liver were normal. A small red line, covered with a thin film of lymph, was found at the former seat of constriction, which was in the ileum, about one and a half feet above the ileo-cæcal valve. There was no constriction of the bowels. The bowel above the former site of constriction was distended, and for about two feet there was local peritonitis, which had also extended downward for about six inches. I consider that death was due to local peritonitis, produced by a continuance of paralysis of the intestine, which had been so long constricted. The rest of the intestine was not the seat of any inflammatory action, except the cæcum, which, on its outer side, was bound by old adhesions to the side of the pelvis. About one foot above the ileo-cæcal valve was a diverticulum of the ileum, communicating with the latter by an opening, one and three-quarters inches wide; its coats were continuous with those of the ileum; it measured two and a quarter inches long, one and three-quarters inches wide, widest at its junction with the ileum. This patient had a possible chance with operation, but none without it.

In the other cases the results have been very satisfactory. All made good recoveries; no recurrences; no one wears a bandage, pad, or truss. No symptoms referable to the cord and testicle, or any other structures.

From a study of the cases cited and comparisons of the methods used by various surgeons, I can only draw the following conclusions: (1) That with careful antiseptic and aseptic

precautions, provided the operator is skilful and familiar with the special anatomic and pathologic conditions associated, an operation for the cure of hernia has a mortality at or about *nil*, or less than that associated with the condition previous to the operation. (2) That sterilized chromicized tendon, or in its absence carefully chromicized catgut, is the most suitable material for buried sutures. (3) That, in closing the wound, (a) the internal ring should be closed by sutures, placing the spermatic cord next to the pubic bone; (b) the internal ring should be reinforced and canal closed by sutures by uniting the internal oblique and transversalis muscles and their conjoined tendon to Poupart's; (c) the cut edges of the external oblique aponeurosis and the pillars of the external ring should be sutured so that the pillars snugly embrace the cord. (4) That in the immense majority of cases the patients are cured by operation. (5) That the operation I have described (a) restores the structures firmly and durably to their normal positions, relations, and uses; (b) has all the advantages of the other methods of operation, but none of their disadvantages; (c) that having many additional advantages, and fulfilling all the indications for a radical cure, it should be followed by the best results.

BIBLIOGRAPHY.

¹ (a) J. C. Stinson, "On the Surgical Anatomy of the Transversalis Fascia," etc., New York Medical Record, December 5, 1896; (b) J. Macready's "Treatise on Ruptures;" (c) H. Morris's "Anatomy;" (d) Gray's "Anatomy;" (e) P. Tillaux, "Traité Anatomie Topographique avec Applications à la Chirurgie;" (f) C. Heath's "Dissector;" (g) J. C. Stinson "On the Radical Cure of Inguinal Hernia," etc., in the Pacific Medical Journal, January 10, 1897, and read before the San Francisco County Medical Society, November 10, 1896.

² J. C. Stinson, "The Operative Treatment of Inguinal Hernia, Preferable Operation," New York Medical Record, March, 1896.

³ J. C. Stinson, "On the Preferable Operation for Femoral Hernia," etc., New York Medical Record, December, 1896.

⁴ J. C. Stinson, New York Medical Record, March, 1896; Pacific Medical Journal, January, 1897.

⁵ Medical Record, March, 1896.

⁶ C. Ford, "The Interrupted Stitch by a Continuous Method," *Pacific Medical Journal*, July, 1896; *Philadelphia Medical Journal*, November 26, 1898.

⁷ "Disadvantages of Non-Absorbable Suture in Operations for the Radical Cure of Hernia," W. B. Coley, *New York Medical Journal*, February 29, 1896.

⁸ J. C. Stinson, *Medical Record*, March, 1896, *Charlotte Medical Journal*, November, 1896.

⁹ Busse, *Deutsche Zeitschrift für Chirurgie*, 1891-92.

¹⁰ J. C. Stinson, in the *Charlotte Medical Journal*, May, 1896; *Pacific Medical Journal*, January, 1897.

¹¹ Marcy, "The Anatomy and Surgical Treatment of Hernia," published by Appleton & Co., 1892.

¹² Robert T. Morris, "Lectures on Appendicitis," notes page 60, published by Putnam's Sons, 1897.

¹³ *The Medical Week*, Paris, December 31, 1897.

¹⁴ *Johns Hopkins Hospital Reports*, May, 1895.

¹⁵ *American Journal of the Medical Sciences*, May, 1895.

¹⁶ In a clinical lecture at the New York Post-Graduate Medical School and Hospital, reported in the *New York Post-Graduate Journal*, September, 1896. W. B. DeGarmo.

¹⁷ *American Medical and Surgical Bulletin*, February, 1896.

¹⁸ *Medical Chronicle*, June, 1896.

¹⁹ "On the Ultimate Results of the Radical Cure of Hernia," in the *Revue médicale de la suisse Romande*, July 20, 1897.

²⁰ Gordon, in *New York Medical News*, July 16, 1898.

²¹ *Medical Chronicle*, June, 1896.

²² *Presse médicale*, June 30, 1897.

²³ *ANNALS OF SURGERY*, November, 1897.

²⁴ I first described this in an article on "Femoral Hernia" in the *Medical Record*, December 8, 1896.

A METHOD OF TREATMENT FOR THE RESTORA-
TION OF ENTIRE TIBIÆ NECROTIC FROM
ACUTE OSTEOMYELITIS.

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ACUTE osteomyelitis is not a disease with which surgery is unfamiliar. The rapidity with which it kills, the deadly character of the infection, and the excruciating torture which its victims suffer make an impression which, when once experienced, is never forgotten.

The clinical facts are well known and have been often recorded. They are that it occurs most frequently in children and young adults, in the long bones, especially in the tibia, and is due to infection. That acute toxæmia promptly occurs produced by a septic thrombo-phlebitis. That infected emboli, metastatic abscesses, and pyæmia rapidly follow. If the patient is not killed at once, drainage, either spontaneous by abscess-formation or by operation, may relieve the condition; but the bone is doomed, and is rapidly killed by interference of circulation, by thrombi, or extreme irritation by toxins.

Modern surgery has learned to recognize these cases early; also that toxæmia can be stopped by prompt treatment and free drainage. The patient's life is saved, but with a dead shaft to be subsequently dealt with.

The natural process of repair is by the formation of new bone from the periosteum of the old shaft, which passes through the various stages of reactive inflammation, formation of granulation tissue, gradual separation of the dead bone, and formation of the sequestrum, the appearance in the granulation area of osteoblasts, the formation of bone trabeculæ, calcifica-

tion, formation of the involucrum, and a new diaphysis, which in cases of central necrosis surrounds and shuts in the sequestrum with a shell of new bone. This becomes as dense and hard as ivory. It is usually lined with ill-nourished granulation tissue. The sequestrum lies free in it, while drainage takes place through sinuses which require months or years to heal, and sometimes never close permanently.

To remove the sequestrum in such a case, close the resulting defect, heal the sinuses, and leave the patient a useful limb has been one of the difficult problems of surgery.

Many methods have been followed, among which may be mentioned the routine opening of the cavity in the new shaft, removing its contents, and trying to cause the resulting defect to be healed and closed by granulation,—a result rarely accomplished. More promising have been the operation of Hamilton's sponge graft, Neuber's skin-flap method, Schede's blood-clot organization, and Hahn's modification, or Senn's implantation of decalcified bone-chips.

The more these cases have been studied and the more the knowledge of the pathological histology of the process has increased, the greater has been the tendency to operate earlier. Discouraged by the long course of these cases and unsatisfactory results, some surgeons have operated at once, and removed the shaft of dead bone in the acute stage, while operating to establish drainage and avoid the danger of immediate death from acute septic intoxication. It was known that the process of repair would produce new bone, and it was hoped that in this way a new shaft would be formed. It was found possible to shell out the entire diaphysis at this time, and it is now occasionally done. The subsequent results have not been, as a rule, satisfactory. I have made an effort to learn the final results in these cases of early complete sequestrotomy, but have found it quite difficult. In the few cases I succeeded in collecting, only one, a case of ablation of the tibia, was found to have a useful leg. The others had either bones not rigid enough to perform their normal function unaided by apparatus or had suffered amputation. Cases are on record where the

regeneration of a diaphysis has occurred after ablation of a necrotic shaft, but the above is my personal observation.

In 1896, after a study of the pathological histology of osteomyelitis and a careful review of the valuable work of Dr. E. H. Nichols ("The Pathology of Acute Infectious Osteomyelitis," by Edward H. Nichols, M.D., "Medical Communications of the Massachusetts Medical Society," 1898, Vol. xvii, No. 3, 875), it seemed to me that better results might be obtained from early sequestrotomy if in any way the proper time for operation could be accurately and intelligently determined.

The facts seemed to show that an operation done too early injured the new periosteum and interfered with the regenerative process. If delayed too long, this process of regeneration was advanced so far as to shut in the necrotic shaft by a bony wall, analogous to the rigid cicatricial base of an old ulcer, so dense as to prevent the growth of any tissue having vitality enough to repair and close the defect resulting from the removal of the sequestrum.

From the experimental work of Dr. E. H. Nichols it is shown that the most favorable time for such removal would be at that stage of regeneration just previous to the extensive formation and coalition of the bone trabeculæ of the periosteum and new-formed granulation tissue,—a time when osteoblasts were abundantly present; when the lime salts were beginning to appear, but before the trabeculæ were extensively calcified. It seemed possible that, if small sections of the periosteum could be examined histologically from time to time, the regenerative process could then be watched until it was positively shown that the above condition or stage was reached. At such a time I could remove the dead shaft with a knowledge that I would leave behind a sheath of granulation tissue and periosteum in the most active stage of bone-formation. If such a sheath could be freed from sources of infection and could be closed by sutures, I could then bury in the centre of the leg by closure of the soft parts and skin over it a solid cord of bone-producing tissue, and in which there would be no chance for the formation of those rigid-walled bony cavities so difficult

to heal after the usual operation of sequestrotomy. A solid bone would be formed, also the primary union of the soft parts by the proposed method would be of great benefit to the patient's general condition, by shortening the period of confinement to bed, and by avoiding the depressing effect of long-continued suppuration.

In 1897 I had an opportunity to test this method, and the result has been so satisfactory that I feel justified in putting it on record and asking a trial of it.

The patient was a boy, sixteen years old, and well at the time of the attack. The infection was supposed to be the result of a blow received while skating. The left tibia was the seat of the disease. The symptoms developed rapidly after the injury. There was intense pain, tenderness, marked constitutional disturbance, and delirium. The condition rapidly became such that the patient's life was in great danger. At the end of the first week the swelling of the leg, at the lower epiphyseal line, indicated that the bone and periosteum were perforated, and at the end of the second week the spontaneous opening of the abscess established drainage, and the patient had a chance for his life.

The first time I saw him was two weeks later (January 28, 1897), on the twenty-eighth day of his illness. He was delirious, emaciated, very pale, and extremely weak. He was reported as having slept during the past four weeks only while so utterly exhausted that the intense pain could not rouse him. The left tibia was evidently necrotic throughout. There was drainage through a sinus just above the internal malleolus. Also an abscess (swelling, redness of surface, fluctuation) near the tubercle of the tibia. The leg was swollen, brawny, œdematous, dusky red, and exquisitely tender.

The abscesses were at once opened freely and curetted, the openings into the medullary canal enlarged, free drainage established, and the struggle for the patient's life began. A bacteriological examination showed the presence of the *staphylococcus pyogenes aureus*.

As a result of the free drainage, stimulation and constitutional treatment, the patient began to improve, and a week or ten days later was out of danger.

The condition of the bone was carefully watched. At the

time it was exposed at the site of the abscess, on the twenty-eighth day, it was dull white in color, and dry. The wounds gradually cleared off as the abscess wall began to show granulations, and later the bone appeared as a white area at the bottom of the cavity, surrounded by the red granulation zone. About February 6 a small section of the granulation area, at the edge where it covered the bone, was removed and examined. On February 20 a second piece was examined. This, although having macroscopically the appearance of ordinary granulation tissue (color, vascularity, and density), was found histologically to contain numerous osteoblasts and many trabeculæ, some showing distinct calcification.

This explained a slight crackling sensation which was noticed when the section for examination was excised, as the knife divided the tissues, and which was probably due to these minute trabeculæ being crushed.

The time had now arrived to remove the dead shaft of the tibia. This was done as soon as the report of the examination of the section could be obtained, which was on March 5, the sixty-fifth day of the disease.

The leg was made bloodless by the Esmarch method. In addition to the usual preparation, the leg was scrubbed just before the operation with soap, hot water, and ammonia, irrigated, wiped with ether, and finally scrubbed with a 1-per-cent. solution of corrosive sublimate. The sinuses were irrigated with peroxide of hydrogen and then with sublimate solution, 1 to 3000. The granulations about the sinuses were burned away with a cauterizing tip. The tibia was exposed by a cut along its anterior surface its entire length. The knife crushed easily through the softened bone cortex at the upper end. The process of disintegration seemed to be more marked at the extremities than in the middle of the shaft. The periosteum was now separated from the dead tibia with elevator and chisel. It peeled off readily as a rule. It varied in thickness from one-thirty-second to one-quarter of an inch, being thinnest over the middle portion of the bone. It was covered in places by scales or thin patches of calcified tissue which were quite adherent to its osseous surface. Some of these areas were two inches long.

When free of periosteum, the bone was divided at its centre and the halves turned out, thus separating or breaking them



FIG. 1.—Showing patient after removal of entire left tibia for acute osteomyelitis.



FIG. 2.—Same patient standing with entire weight of body borne by new tibia.



FIG. 3.—Radiograph of both legs two years after operation.



FIG. 4.—Showing upper half of new tibia.



FIG. 5.—Radiograph of lower half of left leg, showing the lighter shadow in the shaft of the tibia just above the malleolus and in the epiphysis, which was long the seat of the carious process, possibly due to less complete calcification.

away from the epiphyses. The necrotic process was found to have extended into the epiphysis nearly to the joint surface, at both the knee and ankle. At these points the process of calcification of the involucrum was so far advanced as to form a rigid wall around the necrotic area. This was removed, as far as possible, without opening the joint or destroying the epiphysis any more than was necessary to reach normal medullary tissue. The calcified areas alluded to, on the inside surface of the periosteal sheath, were now removed, leaving that tissue flexible. All the suppurating surfaces of the sinuses and abscess-cavities in the soft parts were now removed by cautery, curette, and irrigation (sublimite solution, 1 to 3000).

The periosteal sheath, which was of course united to the superficial structures, was now closed by deep silk sutures throughout its entire length, thus obliterating completely the space previously occupied by the necrotic shaft. A solid cord of periosteum, in the most active stage of bone-production, was thus placed buried in the centre of the leg. The old sinuses (after removal of their walls by dissection to remove all infected tissue) were plugged with iodoform gauze. The defect in the upper epiphysis was treated by the Schede method.

The tourniquet was removed after the dressing was applied. This was made rigid by a plaster-of-Paris bandage.

The patient did well. The rapid improvement in the general condition was quite striking. Three days later the incision was inspected on account of a musty odor, but the Schede dressing or the iodoform packing were not disturbed.

On the seventh day the sutures were removed. The wound was united except at the lower portion. One or two sutures showed slight suppuration at the points of puncture in the skin.

On the eighteenth day the tibia had reformed apparently and was nearly as firm as normal.

On the twenty-third day after the operation the patient could lift the leg from the bed, it was so rigid. The new bone appeared to be one-half to two-thirds larger in diameter than the tibia of the right leg.

On the forty-ninth day the shaft was apparently normal in size and density. It was firm, except at the lower epiphysis, where there was a small sinus (diameter No. 12 French). There was also a small sinus at the upper epiphysis.

On the fiftieth day (April 24) the patient was etherized and the sinuses examined. The lower one was found to enter a cavity which occupied nearly the whole of the lower epiphysis. There was fibrous union with the shaft, but the cavity was shut off from it by dense, firm granulation-tissue, partly calcified. This epiphyseal cavity was curetted, leaving a hole with dense bony walls. An attempt to obliterate this was made by forming a rectangular osteoplastic flap of the external wall of the malleolus, which was then depressed into the defect, fitting it fairly well. The wound in the superjacent tissues was now sutured without drainage. The upper sinus was opened, curetted, and closed by suture.

The upper wound healed at once; the lower nearly so, except a small granulating surface.

On May 14 (twenty days after the second operation) both cavities were apparently filled (the upper by the organized clot, the lower with the bone flap), and ossification begun.

On May 23 (twenty-nine days after the second operation) the lower sinus reopened, and was two and a half inches deep. The patient was up and about on crutches. The leg was supported by a posterior skeleton-wire splint, which extended from the toes to the groin. Later the upper sinus reopened. Cultures from the upper sinus showed staphylococcus aureus and albus; from the lower sinus staphylococcus albus only.

On July 15 the lower sinus was explored again. It was found to connect with a bony cavity containing a small sequestrum. This was removed, the cavity curetted, the sinus in the soft parts dissected out, and the wound closed with a catgut suture. The upper sinus was found to involve the soft parts only, and did not connect with the bone.

Both sinuses healed; the upper one remained so, but the lower one reopened in August. It remained so for a time, but gradually closed again.

In October the patient was well, and about with splint and crutches. The patient, after August, 1897, grew very stout and heavy. Had he been less careless and stupid, so he could be trusted to take proper care of his leg, he could now probably have been allowed to go without apparatus. But on account of this lack of intelligence it was not considered safe to do so, and the splint and crutches were continued.

April, 1898, thirteen months after the removal of the tibia, the apparatus was discontinued, and the patient allowed to use the leg unsupported. The bone was quite firm. The leg was one inch shorter than the right. There was a depression of the soft parts just above the internal malleolus.

Skiagraphic examination shows the bone straight and thinner than the right tibia, but the left fibula was also smaller than the right.

In March, 1899 (two years after the removal of the tibia), the patient again was examined. He is well, strong, and heavy; walks unaided and without difficulty. There is one and three-quarters inches of shortening. The bone is firm. The patient can stand with his entire weight supported by his left leg. On account of the inequality in the length of the legs the pelvis is tilted, and there is a slight lateral spinal curve. This is shown in the accompanying photograph by the position of the iliac crests and the shoulders.

The radiograph shows the bone intact, with a distinct cortex and medullary cavity. A lighter shadow is noticed in the shaft just above the malleolus, and in the lower epiphysis, where the process of repair was delayed and probably the calcification is less in amount.

Present Treatment.—The patient wears a shoe with the sole one and three-quarters inches in thickness on the left foot to prevent scoliosis of the spine.

Summary.—The indications for treatment in cases of acute osteomyelitis are:

(1) To save the patient's life and relieve pain by immediate operation to establish free drainage. The medullary cavity should be opened, pressure relieved, and infection checked.

(2) If the bone is killed, as it usually and rapidly is in a few days, it should be removed.

(3) The most favorable time for its removal is when the periosteum and granulation tissue is in its most active regenerative stage, but before the process of calcification of the bone trabeculæ have shut the sequestrum within a compact, dense shell of involucrum.

(4) This point is to be determined by frequent examinations of sections of the periosteum with the microscope. It is shown by the presence of numerous fibroblasts, osteoblasts, and small trabeculæ in which lime salts are beginning to be deposited.

(5) Clinically it can be recognized by the slight crackling sensation as the periosteum is incised, due, probably, to the crushing of the trabeculæ by the knife.

(6) The periosteum at this stage resembles granulation tissue in color, density, and vascularity. There is no macroscopic appearance of ossification. Bone will be formed from this elastic, flexible, periosteal layer.

(7) This stage in this case was probably reached in the seventh to eighth week of the disease.

(8) At this stage the necrotic bone should be removed by incising the periosteum in the long axis of the leg and shelling out the sequestrum.

(9) The periosteal sheath remaining should be closed by suture, leaving a solid cord or mass of periosteum buried in the centre of the leg when in its most active bone producing condition.

(10) If areas of calcification of any extent or thickness are found adherent to the inner surface of the periosteal sheath, they should be dissected off.

(11) The soft parts and skin superjacent can be closed by suture.

(12) The utmost care and most efficient means should be used to render the operation an aseptic one, for primary union is important.

(13) The new bone is formed rapidly, apparently in eighteen to twenty-four days, when the operation is done at the time above indicated. At this time ossification is so advanced that the new bone is rigid.

(14) If the operation is done too early, the growing periosteum is injured, apparently, and its growth interfered with.

(15) If too late, a rigid bony involucrum makes the re-

moval of the sequestrum more difficult and forms a cavity which is very difficult to close.

(16) It is demonstrated by the radiograph that the medullary cavity is reformed in the new bone.

(17) The shaft of the bone is easier to restore than the epiphysis.

SOME EXPERIMENTS RELATING TO STERILIZATION OF THE HANDS.¹

By LEONARD FREEMAN, M.D.,

OF DENVER, COLORADO,

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IN the early days of surgical cleanliness, the sterilization of the hands was supposed to be easily accomplished; but we have learned that it is a difficult and complicated problem. Micro-organisms, unfortunately, are not strewn upon the surface of the skin, like grains of salt on a plate; but they lie in creases, between and beneath epithelial scales, and down deep in hair-follicles and the openings of sudoriparous glands. The regions about the nails offer particularly favorable hiding-places. It is extremely difficult to reach all these micro-organisms with antiseptics; not only on account of their impregnable positions, but also because they are protected by grease and by being bunched together. The full significance of this bunching is not always recognized; an antiseptic will kill the germs on the outside of the bunch, but cannot reach those within. Some time ago I dried portions of a culture of the staphylococcus pyogenes aureus on a platinum wire, and immersed it for half an hour in 5 per cent. carbolic acid. The antiseptic was then washed away in boiled water, and the wire plunged into gelatin. A luxuriant growth was obtained.

After operating for some time, the hands, which were apparently sterile at the beginning, are often found to be seriously contaminated. In discussions on the subject, this is usually said to be due to maceration in the fluids of the body, and

¹ Read before the American Surgical Association, June 1, 1899.

to friction on tissues and instruments. It struck me that this explanation was not sufficient. It might account for the appearance of a number of germs, but it could not account for all of them. The preliminary scrubbing and maceration of the hands would certainly dislodge most of the bacteria capable of being dislodged by these means. It seemed likely that many germs were floated out of the pores by perspiration, which is generally excessive, owing to the heat of the operating room and the nervous tension of the operator. This hypothesis would also account for the great number of bacteria which appear upon the hands when rubber gloves are worn.

In order to settle the point, I made some experiments, in which I assumed that a single finger, with its palmar and dorsal surfaces, its joint creases, and its nail, fairly represented the entire hand, from a surgical and bacteriological standpoint. As a culture medium I employed gelatin contained in morphine bottles, each bottle being about two-thirds filled. A finger inserted into such a bottle snugly fits the opening, thus excluding atmospheric contamination.

In each experiment the finger was left in the warm, melted gelatin about ten minutes, and continually moved about and rubbed against the bottom and sides of the receptacle, thus simulating, as far as possible, the friction, maceration, etc., of a veritable operation. The flesh was frequently pushed away from the nail against the bottom of the bottle so as to freely admit the gelatin to the subungual space.

Many experiments made to determine the value of methods of cleansing the hands have been rendered valueless by neglecting to remove all traces of the powerful antiseptics employed before immersing the hands in culture media. Very small quantities of an antiseptic, such as bichloride of mercury, are capable of inhibiting germ-growth to a considerable extent. It is not sufficient to rinse the hands in boiled water; chemical means must be employed. Ammonium sulphide answers the purpose well, when bichloride is used, and it is astonishing to note, after careful rinsing in plain water, how black the

fingers will become upon dipping them in the ammonium compound. (The stain can be removed with chloride of lime.)

Experiment I.—Hands scrubbed in warm soap and water, nails cleaned, hands rescrubbed, washed and soaked in alcohol and then in bichloride, rinsed in boiled water, index-finger dipped in ammonium sulphide, and then brought into gelatin. About thirty cultures were obtained.

Experiment II.—The hand was then wrapped in sterilized towels and thoroughly perspired for some minutes in a Beck's hot-air oven. Another immersion of the same finger in gelatin furnished about sixty cultures, just double the original quantity, although, the same finger being used, the number should theoretically have been less.

Experiment III.—The member was then rescrubbed and re-sterilized, and the finger again placed in gelatin. But fifteen cultures were obtained.

Experiment IV.—The sweating process was again gone through with, following which but two cultures appeared in the nutrient medium.

It was thus demonstrated that, although sweating the hands in this instance doubled the number of micro-organisms, a second sweating failed to bring any more to the surface.

It being quite certain that the finger-nails are the most prolific sources of infection, it occurred to me that, by using in addition to the usual cleansing a small, rapidly revolving brush attached to a dental engine, I might clean beneath the nails much more effectively than is usually done. It certainly seemed that I could brush the subungual space with the most minute thoroughness; but, much to my surprise, I obtained so many colonies in the gelatin that I was practically unable to count them. It seemed that I merely succeeded in loosening up the micro-organisms. On another finger, of the same hand, upon which the revolving brush was not employed the germs were found to be much fewer in number.

In order to exclude error the experiments were repeated, with similar results. Wishing to be certain that some of the cultures did not arise from germs contained in the ammonium

sulphide, I poured a little of that compound into gelatin on two separate occasions, with negative results.

I also took occasion to test several processes of sterilizing the hands which are in common use,—the chloride-of-lime method, the mustard method, and the permanganate-of-potassium and oxalic-acid method. With the first two I obtained so many colonies throughout the gelatin that I could not count them. This I attribute largely to the fact that I copied fairly accurately the conditions of a surgical operation, by soaking a finger for ten minutes in warm gelatin, rubbing it with force against the sides and bottom of the bottle, and admitting the culture medium freely beneath the nail. Many experimenters, I believe, have contented themselves with simply immersing the hands in nutrient gelatin and perhaps moving them about a bit, which is not sufficient. With the permanganate-of-potassium method between fifty and seventy-five cultures grew; hence this process, according to my experience, stood next in efficiency to alcohol and bichloride of mercury.

Reinicke was unable to render his hands aseptic either by brushing them for fifteen minutes with green soap and hot water, or by the use of 5 per cent. carbolic acid, 1 to 1000 bichloride of mercury, sublimate soap, chlorine water, 1 per cent. lysol, tricresol, or sand soap.

Based upon my own experiments and those of others, I feel that the following propositions are approximately correct:

(1) None of the methods of sterilizing the hands can be absolutely depended upon. Many positive results are arrived at by means of faulty experimental technique; the culture media becoming impregnated with antiseptics, the skin temporarily hardened by alcohol, formalin, etc., or the hands not subjected to sufficient maceration and friction in the culture medium.

(2) Under circumstances where it seems desirable to do so, much may be accomplished by sweating the hands in a hot-air oven, by wearing rubber gloves for some time prior to an operation, or by immersing the gloved hands in hot water. Mere prolonged soaking in very hot water, although not so

effective as dry, hot air, must have some favorable effect. It is difficult to understand, however, how the sweating method can dispose of all the micro-organisms beneath the nails. The procedure will hardly be extensively employed, owing to its inconvenience.

(3) Excessive brushing beneath the nails, as much even as the sensitive tissues will tolerate, seems merely to stir up the bacteria when carried beyond a certain point. We can hope to accomplish little by this means.

(4) So far, the only really reliable means of rendering the hands aseptic is to incase them in sterilized rubber gloves. But if the gloves become torn, as they often do, the danger of infection is considerable, owing to the bacteria which have accumulated beneath, from perspiration.

Coating the hands with various substances has been tried and found ineffectual.

Cotton gloves, although they soon become contaminated by exudations from the skin, probably do some good, especially if frequently changed, by filtering out the bacteria, as it were, and preventing their entrance into wounds.

STERILIZED WATER FOR OPERATING ROOMS.

By DUDLEY P. ALLEN, M.D.,

OF CLEVELAND, OHIO,

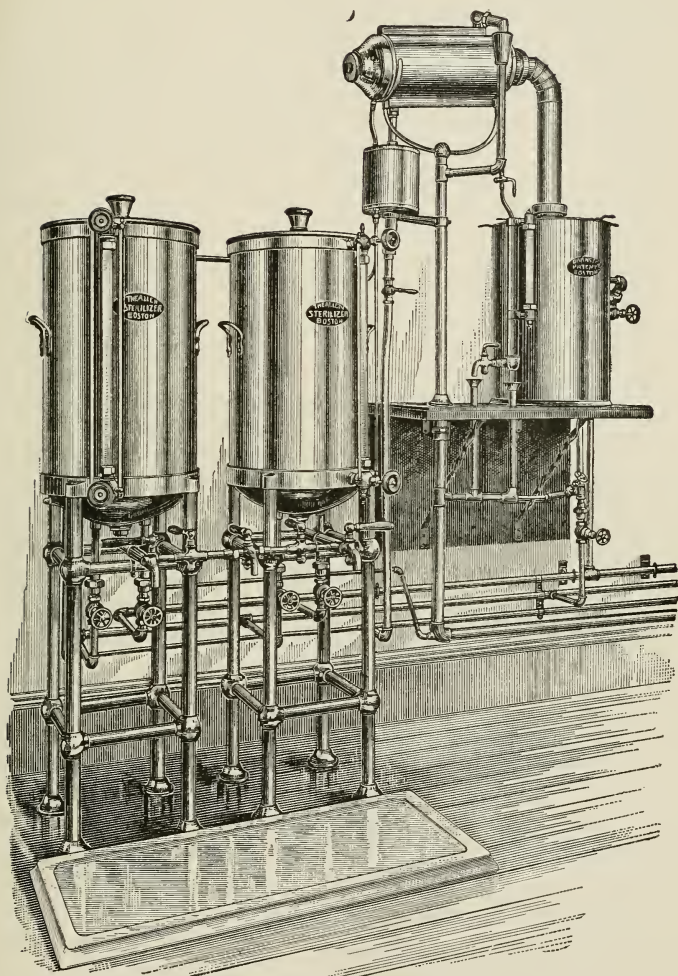
PROFESSOR OF SURGERY, WESTERN RESERVE UNIVERSITY; SURGEON TO
LAKESIDE HOSPITAL.

THE difficulty of securing a single apparatus which will provide a sufficient quantity of sterilized water for a series of operating rooms is so great that a description of the apparatus which is in use in Lakeside Hospital, Cleveland, Ohio, may be of interest.

Before describing the apparatus it may be well to state that it has now been in use for a year and a half. During that time no repairs of any sort have been necessary, except for occasional leakage of steam at the valves, which has been remedied by fresh packing. The water from the tanks has been used in a large number of operations of every sort, and also for saline infusions, and it has also been used when necessary for washing the abdominal cavity. No infection attributable to water has followed in a single case. Clinically this would seem to demonstrate beyond the possibility of question that the water is thoroughly sterile. Two series of bacteriological examinations of all of the tanks have been made. In each series thirty or more cultures have been made from the water drawn from the tanks, exactly as is done for operation. These cultures have been made in the laboratory of the hospital upon blood serum and glycerin agar, and have remained under observation in the thermostat for four or more days. The cultures have been made from the water, as it has stood in the tank for varying periods after sterilization, these periods being from shortly after the water has been boiled until forty-eight hours have elapsed after boiling and before the cultures were

made. In every instance the cultures have been sterile. Since, therefore, the clinical and bacteriological evidences of the sterility of the water seem to be absolute, it will render its preparation of interest, for the reason that the water can be prepared in such great abundance.

The still, which is elevated above the receiving tanks, is made by The Barnstead Pure Water Still Company, 103 Richmond Street, Boston, Mass. Their stills have been in use for a long time in many institutions, and have proved themselves thoroughly reliable and durable, and can be made in sizes to furnish water in any quantity desired. This still can be made to empty itself directly into the two barrel-like metal receivers, which stand upon a framework resting upon the floor. These receivers are built upon a model which I proposed to the Barnstead Company. I do not claim that they are faultless in every particular, nor that they could not be improved upon, but they have the great merit of large capacity, simplicity of construction, and it is very easy to reach every part of them, should this be desirable, for repairs. If several operating rooms are to be provided with sterilized water, the great advantage of the apparatus is that instead of sterilizing the water in a single apparatus, as has been done heretofore in many operating rooms, and then distributing it through a long pipe, the water is distributed after being distilled, and is sterilized in each operating room. By this method I have provided my three private operating rooms and the hospital amphitheatre with sterilized water. In my arrangement, the still, as manufactured by the Barnstead Company, empties its water into a copper-lined tank, the tank being large enough to hold several barrels of water. From this tank a block-tin pipe is carried to the various operating rooms, and by simply turning a cock the water is drawn from the storage-tank into the sterilizing tanks. These sterilizing tanks have double bottoms, between which steam is admitted. A glass indicator upon the tank indicates the point to which it has been filled with water. When the tank is full the hot steam is turned into the hollow bottom, and the water can be boiled by means of steam from the high-



Apparatus for the sterilization of water.

pressure boiler, for any length of time which is desired. The object of having two tanks in a room is that one may furnish hot and the other cold water. Both are filled at night. One is boiled immediately and by morning it has cooled off so as to furnish cold water. The other tank is boiled in the morning before operations. The capacity of each is about thirty gallons, so that two tanks are ample for a series of operations. One great advantage in the apparatus is that one can multiply the sterilizing tanks in as many rooms as is desired with relatively small extra expenditure, and all that is required is to connect them with the original storage-tank of distilled water and with the central steam-pipe.

After observing the appliances for providing water for operations as they exist in a large number of hospitals, I can confidently recommend this as presenting especial advantages in three ways,—first, simplicity of construction; second, the opportunity furnished for multiplying indefinitely the apparatus in various operating rooms at small expense; and, third, in sterilizing all water after its distribution to the operating rooms rather than before distribution, thus obviating the necessity of carrying sterilized water a long distance with possibility of reinfection. In addition to the above advantages, the apparatus can be cleaned with great ease, and every part is very easily reached should repairs become necessary.

STRANGULATED INTERNAL HERNIA THROUGH A MESENTERIC HOLE.

By LOUIS J. MITCHELL, M.D.,

OF CHICAGO.

J. F., a boy eight years old, was sent on an errand on January 17. He ran down the outside stairs, and when near the bottom the guard-rail gave way and he fell into the yard, striking on his abdomen on the frozen ground. The boy picked himself up and went back to his mother, told her of the accident, and then completed the errand. Nothing further developed until the morning of the 19th of January, when he complained of severe pain in the abdomen; a physician was called in, who diagnosed peritonitis, but unfortunately instituted no operative measures. Death ensued on January 21.

The necropsy showed an opening in the mesentery near the ileo-cæcal junction which presented smooth margins. Several loops of bowel had passed through this and had become strangulated, being dark cherry-red in color. The parietal peritoneum in the vicinity was red also and had some flakes of lymph on its surface. The examination revealed no further facts bearing on the case.

Mr. Treves, in the Hunterian Lectures for 1885 ("The Anatomy of the Intestinal Canal and Peritoneum in Man"), explains the formation of these holes.

"In the foetus," he says, "it will often be observed that the ileo-colic branch of the superior mesenteric artery circumscribes by its anastomosis with the last of the intestinal arteries an area on the mesentery of a well-rounded or oval shape. This area is remarkable in so far that it presents no fat, no visible blood-vessels of any kind, even in well-injected specimens, and is never occupied by any mesenteric glands." A

little further on he adds: "It will be seen that this area has the precise situation, the outline, and the dimensions of the mysterious mesenteric hole, and by the atrophy of the peritoneum occupying the district such a hole would be formed." The author then describes a case where this area was entirely devoid of fat, while the surrounding mesentery was quite opaque from the depositing of fat, and the writer has also noted a similar case.

During the writer's service as coroner's physician, in considerably over 1000 necropsies, genuine holes were met with only three times, or one in over 500 cases. The first was a male child, at term, in whom the opening was circular and one-half inch in diameter. The second was in a man of twenty-four; here the aperture was located in the same region, the ileo-cæcal junction, but was elliptical, measuring one by three-quarters inches. In the third case, a woman, of forty-five, had an elliptical hole in the mesentery of large size, one by one and seven-eighths inches. Like the others, it was situated near the union of the small and large intestines, and the upper end was partly occluded by a thin membrane, three-eighths by seven-eighths inch. In none of these three cases was the cause of death connected with the presence of the holes.

In the case of the little boy, first described, of course it is impossible to determine whether the hole was entirely open, or whether it was closed in by a cribriform membrane, such as Mr. Treves alludes to, and the traumatism forced the bowels through the perforated layer.

This variety of internal strangulation, while not exactly rare, is somewhat uncommon, and it would seem that the explanation is furnished by the comparative infrequency of the mesenteric holes.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, April 26, 1899.

The President, ANDREW J. MCCOSH, M.D., in the Chair.

COMPOUND DEPRESSED FRACTURE OF THE SKULL.

DR. PARKER SYMS presented a boy, eleven years of age, who was admitted to Lebanon Hospital, March 28, 1899, having been injured by a board falling from the top of a high building, the corner of the board striking him on the head. The patient walked to the hospital and was examined. The diagnosis was made by the house surgeon, but the patient's friends refused to let him remain in the hospital. He walked home, then later walked to the hospital again, and remained for treatment. On examination of the head a lacerated wound of the scalp was found. The edges of the wound being retracted, a compound depressed fracture of the skull was brought to view. This fracture was situated at the superior posterior angle of the parietal bone. There were no systemic symptoms. The patient did not lose consciousness, had no paralysis and no convulsions,—in fact, no symptoms of cerebral injury.

When the wound had been enlarged, and the fracture fully exposed, it was found that there was a complete depression through both tables of the skull, about two and a half inches in length and about an inch in width. A trephine incision was made just posterior to this depression, and the whole of the broken part was elevated and removed. The dura was not ruptured, but under the skull, some distance from the margin of the fracture, in various directions, were found pieces of coal and a fabric, apparently part of the boy's hat, and other foreign substances. These were carefully removed. Part of the skin flap was sutured, a space being left for drainage. A piece of rubber tissue was

inserted next to the dura; a piece of iodoform gauze was placed over this beneath the scalp. The wound had entirely healed, and the patient was discharged cured without any abnormal symptoms or evidences, the time in hospital being three weeks.

MULTIPLE GUNSHOT INJURIES.

DR. LEWIS A. STIMSON related the following occurrences: A soldier walking in the street, a month previous, was requested by a by-stander to show how his gun worked. He complied, inserting a cartridge, which was of the Krag-Jorgensen type, the diameter of the bullet being about eight millimetres. The gun was accidentally discharged, and the bullet, in its course, wounded three men. The first man was struck in the right arm, above the elbow, the bullet entering about the centre of the arm in front, and coming out posteriorly. The second man, who was standing with his thumb caught in the button-hole of his coat, so that his arm rested across the body, was struck between the first phalanges of the middle and index-finger of the right hand, making a small wound on the side of each finger. The bullet then passed upward, through the palm of his hand and the forearm, and emerged on the inner side above the elbow, making a ragged wound. It then entered the arm of the third man and lodged there, producing only a flesh-wound.

In the first man who was injured, the wounds of entrance and exit were small and circular. Two skiagraphs of this case were exhibited. They showed an oblique fracture of the humerus, about three and a half inches long, passing downward and forward with a small splinter at each end, and about the centre of it the track of the bullet can be made out. This patient only remained in the hospital one day, and made an uneventful recovery. The bullet in this case not only perforated the bone, but produced an oblique fracture without the comminution so frequent in former cases when the bullet was large and the velocity low. The plane of the fracture was at right angles to the track taken by the bullet.

The second man who was injured was shown by Dr. Stimson, and several skiagraphs of the case were exhibited. These showed that the bullet, in its course, had fractured the base of the second metacarpal bone, together with the trapezoid and

scaphoid, and had then comminuted the distal end of the radius for about four inches. In addition to this, there were five longitudinal lacerations of the skin, each about four inches long, on the outer aspect of the forearm. These lacerations were due to the sudden violent transverse distention of the limb as the bullet passed longitudinally through it. This patient remained in the hospital for five days and then was treated in the Out-Door Department. His wound healed primarily, and his radius is now sufficiently united to produce rotation of the upper end of the bone when it is turned. He can also move his fingers. The forearm is still swollen.

RECURRENT CARCINOMA AFTER AMPUTATION OF BREAST.

DR. ELLSWORTH ELIOT, JR., presented a middle-aged woman, who first came under the speaker's observation four years before. At that time she had a mass in the right axilla, near the anterior boundary, which had troubled her for about six months, giving rise to considerable pain. She stated that she had first noticed the mass about six years before coming under observation. Examination showed a typical carcinoma, which was peculiar, from the fact that it was not situated in the mammary gland, but in a rudimentary nipple near the axillary fold. The disease was sufficiently far advanced to have involved the skin.

The patient was operated on at the Presbyterian Hospital, the usual operation being done. The pectoral muscles and the axillary contents were thoroughly removed. Upon reaching the apex of the axilla, a distinctly enlarged gland, about the size of an ordinary marble, was found and removed. The wound healed primarily, and for a year afterwards there were no external evidences of a recurrence. Then a number of masses appeared above the clavicle. In order to satisfy himself that the recurrence was of a malignant character, the speaker said he enucleated one of the nodules through a small incision, and subjected it to a microscopic examination, which proved that it was undoubtedly carcinomatous. Owing to the multiple character of these metastases, nothing further was done, the patient simply being kept under observation. She has been capable of doing her housework with very slight inconvenience, and suffers only occasionally from swelling of the arm.

This case was interesting, Dr. Eliot said, from two stand-points: First, that the patient should have suffered from carcinoma in this region for such a length of time without its having made further inroads upon the general system; second, that the primary seat of the disease was in one of the accessory nipples near the axilla.

Dr. Eliot said there was no recurrence in the cicatrix. He has noticed that the recurrence in such cases is almost invariably supraclavicular, and for that reason he thought the supraclavicular fossa should be cleared out at the time of the primary operation, if the condition of the patient permits, rather than later, at a secondary operation. Dr. Eliot said his patient had lost no flesh or strength, and was in excellent physical condition. The carcinoma was regarded by the pathologist as belonging to a not very virulent variety.

INOPERABLE SARCOMA TREATED WITH THE MIXED TOXINES OF ERYSIPELAS AND BACILLUS PRODIGIOSUS.

DR. WILLIAM B. COLEY presented a woman, thirty-five years old, who first came under the speaker's observation in April, 1894. She stated that in 1887 she had sustained a fall, injuring her buttock on the left side. Three months later a swelling appeared at the site of the injury, which gradually increased in size. This was removed by Dr. McBurney, at Roosevelt Hospital, July 31, 1890. (The hospital records state that the tumor was the size of a child's head, and the pathologist's report showed it to be sarcoma.) A recurrence took place in three months, and when Dr. Coley first saw her, in 1895, there was a tumor in the left gluteal region, which measured seventeen inches vertically and the same distance transversely. It was very firm, having a consistence resembling cartilage in some places and ordinary sarcoma in others. It was firmly adherent to the underlying bones. The skin covering it was discolored and much hypertrophied.

The patient was admitted to the Post-Graduate Hospital in April, 1894, and for two months she was given injections of the toxines of erysipelas and bacillus prodigiosus. This resulted in only a slight decrease in the size of the tumor, and the patient,

becoming somewhat discouraged, was discharged, and the treatment was considered a failure. Shortly after the patient left the hospital, however, the tumor slowly decreased in size, and this continued for two years, when it had nearly disappeared. Within the past year a slight increase in size has taken place. At present there are a number of discrete masses, one as large as an orange and quite movable. Just above this is a larger mass, about seven inches in diameter, and below is a third mass which is slightly connected with the upper one. Instead of a single large mass, such as she had five years ago, there are now three distinct masses, but very much smaller in size.

Dr. Coley said he could ascribe the slow regression of the growth to nothing else but the use of the erysipelas toxines. The speaker said he expected to remove the smallest of the three growths in a few days, and submit it to a bacteriological examination. The most successful results with the erysipelas treatment, in his experience, were in cases of spindle-celled sarcoma.

[The two larger tumors were removed under ether anæsthesia and found to be entirely made up of dense fibrous tissue. No sarcomatous elements could be found, though a careful examination was made at the New York Cancer Hospital laboratory. In the light of the early history available through the courtesy of Dr. McBurney, this case becomes one of great importance and of scientific interest. The history shows that the original tumor was the size of a child's head, removed July 31, 1890, and was a sarcoma. The history contains a later note, stating recurrence three years later; non-operable. The conditions in April, 1894, when the toxines were first administered, was hopelessly inoperable, and getting rapidly worse. From that time a slow but steady decrease in size occurred with improvement in general health, and the patient is to-day, upward of five years later, well, with only the dense fibrous base of the original tumor left, and the most of this has been recently removed.]

INJURY OF THE CAUDA EQUINA, SIMULATING SPINAL CORD INJURY.

DR. PERCY R. BOLTON said that, at a meeting of the society one month ago, when he had read his paper on the treatment of

injuries of the spinal cord, some of those who participated in the discussion referred to cases where improvement had followed laminectomy in supposed injury of the cord, low down, and the speaker had replied that he saw no reason why the symptoms in those cases were not due to injury of the cauda equina rather than of the cord itself.

In order to illustrate how closely the symptoms in these two classes of cases may simulate each other, Dr. Bolton showed a young man who, about a year ago, was shot in the left side of the abdomen with a 32-calibre bullet. He became paraplegic, and was taken to the hospital, where his abdomen was opened in the median line, in order to ascertain whether any injury of the intestines had occurred. He recovered from this operation, which was done in Connecticut, but as his paraplegia persisted, with complete retention of urine and fæces, he was sent to Bellevue Hospital, where Dr. Bolton first saw him last summer. The case was looked upon as one of injury to the cord. There was almost complete loss of power in both legs and the posterior muscles of the thighs, and a saddle-shaped area of anæsthesia around the anus, and extending down each thigh.

After several attempts, two good X-ray pictures were secured, one taken in front, the other behind, which showed that the bullet was not in the lumbar region, where it was supposed to be, but opposite the first sacral vertebra. An operation for its removal was undertaken by Dr. Bolton in October, 1898. An incision was made low down posteriorly in the median line, the spinal canal opened, and then, with the finger, the bullet was removed from a small cavity in the sacral region, where it had become encysted within the dura among the cords of the cauda equina. It lay inside the posterior layer of the dura mater among the nerve-fibres, probably cutting off those fibres which supplied the sphincters, the sensory fibres going to the inner thighs, and those distributed to the posterior femoral muscles, and those of the legs.

Since the removal of the bullet the patient's legs have become a little stronger, but he still has trouble in controlling the sphincters of the rectum and bladder.

The interesting point about the case, Dr. Bolton said, was the practically exact similarity of the symptoms to those observed after injury of the lumbar cord.

NEPHROTOMY FOLLOWED BY NEPHRECTOMY:
IMPLANTATION OF BOTH URETERS INTO
BLADDER AFTER REPEATED
ATTEMPTS.

DR. F. LANGE presented a woman, forty-three years old, who, after having been operated on by an experienced gynecologist of this city, in May, 1897, for cancer of the uterus, found that her urine escaped through the vagina. Examination showed a small, red protrusion in the vault of the vagina (the uterus having been extirpated) from which all the urine escaped. It was not possible to clearly make out the ureteral apertures. On the right side, however, an elastic probe could be introduced for several inches. The patient had complained of chills and feverish spells at various times; also occasional pains in the region of the kidneys.

On February 12, 1898, it became necessary to open the right kidney by lumbar incision. It contained a pretty large quantity of offensive, thick pus. The ureter at the entrance into the pelvis seemed to be narrowed and was split, the pelvis incised and drained. On March 8, 1898, median incision. Fruitless attempt to proceed behind the peritoneum on account of adhesions. Abdominal cavity had to be freely opened. First the right ureter was laid bare, which was facilitated by passing bougie from above through nephrotomy wound. On the left side great difficulty in removing the tube and ovary, which had been left and were firmly matted to the floor of the pelvis. Finally both ureters were laid open, stripped of their covering to the distance of about two to three inches, and implanted into the fundus of the bladder, after they had been cut across as close to the vaginal roof as possible. They were united to the parietes of the bladder by buried thin catgut, and additional supporting silk sutures. None of them passed through the lumen of the ureter. Long threads of silk were passed through the free ends. They were pulled through the urethra and tied over a short piece of drainage-tube, thus exerting a slight elastic traction upon the ureters.

On the right side the wall of the ureter was rigid and thickened, and there a slight tension could not be obviated. About three or four weeks later it became apparent that only the left ureter had healed in. The right one had retracted and the wall

of the bladder had united over it. A number of attempts were made to cauterize through the wall of the bladder over the retracted ureter, a bougie having been passed from above through the still existing nephrotomy-opening. Kelly's cystoscopy was done for this purpose. But the ureter had evidently retracted itself too far, and the attempts were given up as too dangerous.

In the beginning of May the bladder was freely opened above the pubes, its posterior wall incised, the ureter pulled forward and reunited. This time also the peritoneum was opened, because it proved to be impossible to strip it back. The operation was successful, and soon all the urine was passed through the bladder. After repeated drainage of the pelvis of both kidneys through the newly established ureteral openings and free irrigation, the condition of the urine improved, and the patient was discharged in June.

Four months later it was reported that her condition had, for some time, been tolerably good. Later, however, symptoms of retention on the left side, the previously better one, had set in, and when seen by the reporter she presented the symptoms of a pyelonephritis on that side. The pelvis of that kidney contained thin and offensive pus, which could not be washed away through the narrow tube. The urine drawn from the right ureter was, however, much improved, almost clear, and that side seemed to have returned to a fairly normal condition.

On the 3d of October the left kidney was laid open. It was found full of abscesses and had to be removed, the patient showing progressing septico-pyæmic symptoms. She made a good recovery; though, on account of adhesions and the size of the kidney, the operation was difficult, and the last rib had to be resected.

On the 12th of November she was discharged with only a small sinus at the seat of extirpation, which closed entirely several weeks later.

Dr. Lange presents the patient in order to show how the general condition of the patient has improved. She is now in a flourishing state of health.

The urine is not normal yet. It contained leucocytes and a moderate amount of mucus. No casts. It is of light specific gravity, owing partly, perhaps, to the great quantity of fluid which the patient takes every day. But the quantity of urea excreted in twenty-four hours is about normal.

CONTINUOUS DRAINAGE OF BLADDER.

DR. JOHN B. WALKER read a paper with this title.

In connection with his paper Dr. Walker demonstrated the apparatus which he employed in continuous drainage of the bladder.

DR. ROBERT H. M. DAWBARN said that, while the apparatus shown by Dr. Walker worked very effectively, he failed to see what advantage it had over the one which he had shown three or four years ago. The principle was that of the siphon drainage, which was first devised by Dr. Snow, a dentist, of Buffalo, now dead, about twenty-five years ago. The same method is now generally employed by dentists for the purpose of keeping the mouth dry during dental operations. A similar apparatus was devised by an English physician about seven or eight years ago, with an S-shaped glass tube, which served as a trap; and with a similar device by Dr. Keen, in this country. Dr. Dawbarn said that the only respect in which his own method seemed superior to that of Dr. Walker was in its extreme simplicity: it consisted, essentially of a fountain syringe, and the trap was simply made by *tying a knot in the exit tube*, by which a trap of unusual shape is made, but is in effect identical with the usual one. In addition to this, there is a T-shaped tube, and the flow of water is regulated by pinching the rubber tube with an artery forceps or with the clasp that accompanies all fountain syringes,—removed from the end and snapped, instead, on the side of the tube. By this device Dr. Dawbarn positively asserted that the bed will be kept perfectly dry, and with no attention from the nurse except to refill the reservoir once in several hours. There is no discomfort to the patient, and there is hardly any expense attached to the apparatus. One advantage of the glass attachment to Dr. Walker's apparatus was that the urine could be seen flowing through, but its brittleness (being almost all glass) and expense were disadvantages. Dr. Dawbarn said that Dr. Weir had written him, approving of his apparatus, but adding that it works better when an outside or additional tube enters the bladder also. This Dr. Dawbarn had also noted of late, where the bladder-wound had become, in some ways, a close fit for the entering tube, thereby preventing the necessary air-pressure within the bladder without

which the device cannot work well, of course. Therefore he now slips a large rubber tube, a few inches long, over the entering tube, stitching them together at one or two points. Between these tubes air enters as needed.

The most comfortable exit-tube is a soft rubber catheter, in size about 28 to 30 French, and with its end clipped off beyond the eye,—thus leaving two openings just as with a stomach-tube. This catheter may join the fountain-syringe tube by a short glass tube, if it is desired to see the fluids running through.

Dr. Dawbarn offered to demonstrate for any member the effectiveness and simplicity of his drainage device at any time.

DR. L. A. STIMSON asked if the principle of the apparatus demonstrated by Dr. Walker was that which had long been made use of in physiological laboratories to produce a vacuum by the passage of a stream of water, and like that of the common atomizers, in which a stream of air is used.

GALL-STONE.

DR. PARKER SYMS exhibited a gall-stone, which he had removed from a man, sixty-three years old, who was admitted to Lebanon Hospital on June 17, 1898. The patient complained of vague pain and tenderness in the abdomen. On examining, a freely movable, apparently solid, rather large mass could be felt below the margin of the liver. The patient gave no history which would aid in diagnosing his condition, simply complaining of pain and tenderness which he said had been present for an indefinite but long period, but which had never given him much discomfort. A provisional diagnosis of a distended gall-bladder or of the carcinoma was made; the operation was done on June 22. After opening the abdomen the mass was found to consist of the gall-bladder, which was entirely filled with one large stone. The gall-bladder was incised, the stone removed, then the gall-bladder was stitched with a double layer of Lembert sutures. The abdomen was closed, and the patient made a speedy and uneventful recovery, leaving the hospital within three weeks. The stone was found to weigh two ounces and five drachms. It measured seven inches in its largest circumference and five and a half inches in its smallest.

BRANCHIAL CYST.

DR. ELIOT showed a branchial cyst which he had removed a few hours previously. The patient was a man, twenty-two years old, who had noticed a lump in the submaxillary region for six months, which gradually increased in size. Upon operating, a branchial cyst was found, occupying the usual position behind the sterno-cleido-mastoid muscle. The speaker referred to a similar operation which he had done four or five years ago. He stated that these cysts, as a rule, remain small for a long time, usually beginning to enlarge about the age of puberty.

EDITORIAL ARTICLE.

SURGERY OF THE HEART.

- (I) NINNI: "Sutura del cuore par ampia ferita di ventricolo sinistra," *Giornale internazionale delle Scienze mediche*, Gennaio 15, 1899.
- (II) RYDYGIER: "Ueber Herzwunden," *Wiener klinische Wochenschrift*, 1898, No. 47.
- (III) GIORDANO: "Di un nuovo metodi di apertura del mediastino anteriore (resezione osteoplastico delle sterno)," *Centralblatt für Chirurgie*, 1899, No. 19.
- (IV) ELSBERG: "Ueber Herzwunden und Herznoth," *Centralblatt für Chirurgie*, 1898, No. 43.
- (V) PODREZ: "La Chirurgie du Cœur," *Revue de Chirurgie*, 1899, No. 5.
- (VI) LOISON: "Des Blessures du Péricarde et du Cœur et de leur Traitement," *Revue de Chirurgie*, 1899, Nos. 1, 2, 6.
- (VII) TERRIER ET REYMOND: "Chirurgie du Cœur et du Péricarde," 12mo, pp. 212, Paris, 1898, Félix Alcan.

(I) NINNI's patient, thirty-three years of age, received a knife-wound in the chest. This happened in the vicinity of the hospital, a few hundred feet in front of which he collapsed. The patient was at once taken into the ward where Ninni was occupied: a wound in the fifth left interspace, in the mammary line, was found. Stimulation was resorted to, but the condition continued precarious. Pallor almost cadaveric; no radial pulse; the heart beat tumultuously, yet no visible pulsation. An incision

was made in the fifth interspace, close to the margin of the sixth rib, as far as the mammary line. Along the sternal margin to the third rib a vertical incision, and another horizontal incision in the third interspace. This quadrilateral osteo-musculo-cutaneous flap was turned to the left, with preservation of the pleura. Owing to the large amount of blood in the pleural space, which obscured the pericardium, the pleura was incised and the coagula turned out. The pericardium was found enormously distended, bearing a wound of three centimetres. This was enlarged with a bistoury, whereupon a large stream of blood and coagula escaped. The patient at first remained insensible, thereafter became agitated (no anæsthetic used). The hæmorrhage from the heart was temporarily controlled by the introduction of the index-finger. The wound of the heart was twenty-five millimetres in length, situated in the anterior wall of the left ventricle, slightly below the transverse sulcus, and a little to the outer side of the longitudinal sulcus, parallel to the long axis of the heart.

Two sutures of silk passed through the muscle effected a perfect hæmostasis. The pericardium was closed by continuous suture. While the pleura was being cleared of clots, and before the cutaneous flap was adjusted, the patient died.

Ninni details eight cases of heart-wound, his own inclusive, in which suture was resorted to, with three recoveries,—i.e., $37\frac{1}{2}$ per cent. These are as follows:

(1) Farina (*Durante: Revue de Chirurgie*, 1897, p. 335): A wound seven millimetres long, involving the apex and the margin of the right ventricle. Immediately sutured, but the patient died of causes unknown; probably pneumonia.

(2) Rehn (*Centralblatt für Chirurgie*, 1897, No. 28): Patient, twenty-two years old. Stab-wound in the fourth interspace. Administration of stimulants followed by improvement. Twenty-four hours later the condition was so much worse that operation was resorted to. Ether narcosis. Resection of the fifth rib; pleura cleared of blood; the small wound in the pericardium was

enlarged, and the wound in the right ventricle, one and a half centimetres, sutured with three silk threads. Drainage of the pleura and pericardium; recovery.

(3) Cappelen (*Norsk. Mag. f. Lagevedinsk.*, Christ., 1896). Patient was wounded at the apex and edge of the left ventricle, and the left coronary artery severed. Operation after several hours, which was followed by primary union, but the patient died two and a half days later of pericarditis.

(4) Parozanni: (a) Male, aged thirty-two years. Dagger-wound in the seventh interspace. Marked anæmia. Operation. No narcosis. Osteo-musculo-cutaneous flap; pleura exposed; pericardium incised. Heart-wound at apex; index-finger introduced to temporarily control the hæmorrhage, and then two silk sutures passed merely through the myocardium. Time of operation, one and a quarter hours. Auto-transfusion; recovery. (b) Dagger-wound in the third interspace; young woman. No narcosis. Operation lasted forty-five minutes. Infusion and stimulants. Heart-wound in the anterior wall of the left ventricle; two sutures passed through the myocardium. Death twenty-four hours later. Autopsy. No leakage from the heart-wound, but pleurisy on the left side antedating the operation(?).

(5) Giordano: Wound two and a half centimetres in length, situated at the margin of the left ventricle. Two and a half hours after injury heart and pericardium sutured. Pleura drained, but patient succumbed twenty days later from septic pleurisy, left-sided, and multiple metastatic abscesses of the right lung.

(6) Parlavecchio: The wound was V-shaped, and measured three centimetres. Suture eight hours later. Recovery.

(7) Rudis-Jicinsky (*New York Medical Journal*, 1898). This case is not accepted as a penetrating wound, because no operation was performed confirming the diagnosis, which was merely based on the direction of the probe.

Ninni says that, according to the statistics of Jamain, Fischer, and Latenelet, death is instantaneous in 10 per cent. of the cases

of penetrating wounds of the heart. If to these are added the 152 cases of Zannetti, with fifty-four deaths, the instantaneous mortality is increased to 18 per cent.

Ninni rejects the ten cures reported by Zannetti, because of the want of proof from autopsy *in vivo* or post-mortem.

As causes of death at remoter periods Ninni enumerates compression of the heart from the escaped blood, complications of the adjoining viscera, and infection of these. Loss of blood from secondary hæmorrhages. Ninni gives a list of operations performed by various operators to expose the heart.

Del Vecchio ("Sutura del Cuore," *Riforma Medica*, 1895, Nos. 79, 80): H-shaped incision. The vertical incisions corresponding to the left sternal and mammary lines respectively: an horizontal incision in the fourth interspace joining these two, with resection of fourth, fifth, and sixth ribs. One bone-muscle—skin-flap turned up, the other down. Farina, Rehn, Parlavecchio, and Cappelen resect one or more ribs. Parozanni made a J-shaped osteo-musculo-cutaneous flap. Incision in the fifth interspace, three centimetres from the sternum, from the beginning of this a vertical incision down to the ninth rib, with section of the sixth, seventh, and eighth ribs, and the flap turned outward. In the second case a similar incision, with section of the fourth, fifth, and sixth ribs.

Giordano: Incision in the third interspace, section of the third and fourth ribs. One raised up, the other down.

As the result of studies on the cadaver, Ninni suggests the following method: Incision along the sternum from the third to the sixth rib, and the same length in the mammary line; joining these a horizontal incision in the fifth interspace. Section of the intervening ribs and the bone-muscle skin-flap turned upward. Pericardium to be sutured continuously for reasons of haste and the mediastinum drained.

A few of the cases were operated without the use of an anæ-

thetic, and in most infusion was practised. Ninni did not refuse having but one assistant, though he commends it.

Fischer¹ calls attention that most of the cases that recovered from penetrating wounds had several attacks of syncope from the loss of blood. Hence the justification of venesection in the older works and recently mentioned by König. But the heart acts more violently with a diminished volume of blood to contract upon, and therefore the propriety of infusion; yet autoinfusion with hypodermoclysis and enteroclysis would accomplish the same effect without suddenly increasing the blood-pressure. A large amount of blood can also be held in reserve by constricting one or more limbs.

Elsberg has confirmed the experiments of Bode² that wounds of the ventricles in animals are better borne than those affecting the auricles, and that suture is effective, interfering but momentarily with the heart's action.

Rehn recommends to apply the suture in diastole, for in systole the heart sinks back into the pericardial space. Rehn thinks it advisable to incise the pleura to avoid the negative pressure from aspirating air into the mediastinum, causing the blood to foam.

Though justified by Rehn, the use of a probe to ascertain the nature of the injury is a flagrant departure from the surgical tenets of the day.

Ninni concludes by saying, "Systematic abstention has not the least *raison d'être* in penetrating wounds of the heart."

(II) Rydygier contributes to this subject his choice of incision as studied on the cadaver. A horizontal incision at the upper level of the third rib, extending a little to the right of the sternum and as far as the left costo-chondral articulation, then an oblique incision along the outer ends of the costal cartilages, as far as the

¹ Archiv für klinische Chirurgie, 1868, No. 9.

² Bode, "Versuchen über Herzverletzung," Beiträge zur klinischen Chirurgie, 1897, xix, p. 197.

fifth interspace. The periosteum of the sternum is elevated and the sternum divided with forceps, chisel, or saw. The third, fourth, and fifth costal cartilages divided at their junction with the ribs. This osteo-musculo-cutaneous flap is turned to the right, and the sixth rib divided, if necessary. The pericardium and pleura are preserved, being pushed aside with the raspatory.

(III) Giordano: A vertical incision close to the sternum, dividing the second and third cartilages; at the upper and lower limits of the vertical incision transverse incisions across the sternum. The sternum is divided with a chisel and the flap turned to the left by luxating the cartilages. In raising the sternum the pleura and pericardium are separated by the raspatory. The bone is subsequently replaced, to be united with wire sutures.

(V) Podrez, in some historical introductory remarks, gives his support to the views entertained by Fischer and Jamain on the viability of patients afflicted with heart wounds. The classification of penetrating and non-penetrating wounds of the heart still holds good, and while the latter might terminate spontaneously in recovery, the former would eventually lead to death from paralysis and degenerative changes in the heart muscle and secondary hæmorrhages. According to Ollier and Sanson, wounds of the auricles and those oblique to the long axis of the heart are the more fatal, and large wounds, in spite of all interference, will cause death, while survival for hours and days will follow the lodgement of foreign bodies.

Podrez is much impressed with the significance of hæmorrhage. Whereas it cannot be denied that the immediate effect of hæmorrhage and the syncope, incident to it, favor the formation of clot between the lips of the wound, yet the subsequent secondary hæmorrhages are responsible for the fatal issues (Pirogoff); therefore operative interference in every instance ought to be early.

Diagnosis.—The site of the injury and the clinical signs are

very significant. In general, it can be said that every penetrating wound of the thorax in the precordial region touches the heart or its envelope, at a variable point according to the nature of the traumatism; however, the heart may be wounded by an injury very remote from the precordial area.

Physical Signs.—Syncope, shock, hæmorrhage, visible and concealed from the wounds; altered respiration, altered heart-beat and pulse, and an increased area of cardiac dulness. To these are to be added nervous symptoms,—vertigo, convulsions, vomiting, and even temporary hemiplegias (Pirogoff). The shock not only depends on hæmorrhage, but on difficult and violent heart action, wherefore the fundamental rule ought to be to lose no time with cardiac stimulants, but to turn out clots, seek hæmorrhage, and prevent the same by a suture. This is the best guarantee against all complications.

The nervous phenomena referred to are more common in injuries to the left ventricle, and are due to the anæmia of the spinal cord. If the right ventricle is injured, interference with respiration is more marked, yet respiratory difficulties may be due to influences from the nervous centres.

Wounds of the coronary arteries are always fatal. Animal experiments indicate as the cause of death not the loss of blood, but the lack of blood in the cardiac muscle, whence its nutrition suffers and its action is arrested; therefore injury of the coronary artery cannot be a question for surgical treatment.

The heart impulse is irregular and very rapid, 120 to 140, the action being peristaltic. The heart-sounds are prolonged and feeble, and at times masked by a bruit like that of aneurism. If there is much of an exudate, pericardial friction-sounds are present.

A complete restitution of function has not been obtained in any of the cases heretofore recovered, except in the author's own patient.

An entire closure of pericardial wounds greatly influences

restitution of function. Wounds of the pericardium are intimately linked with the heart's action, and the symptoms are common to both, so much so that it is impossible to differentiate whether one or both are injured. Air embolism as a cause of death is to be thought of when the local conditions are not sufficient to explain the cause of death. This air enters the ventricles in diastole when the blood-pressure is negative. The direction of the heart wound has not the importance attached to it, for the muscle fibres cross in different directions. A spontaneous arrest of hæmorrhage is possible only in the minutest wound, and more frequently in the right heart, where the presence of carbonic acid gas favors the coagulation.

As the result of these observations, Podrez advises, in every instance, that one establishes the signs of hæmorrhage or compression of the heart following a penetrating injury of the thorax, be it that the pericardium alone or the heart in addition is injured, to make a large incision in the cardiac region. The enfeebled condition of the patient and the technical difficulties at times are insurmountable objects towards accomplishing this.

Operation.—The studies of Mignon, Delorme, Voïnitch-Sianojentszky have shown that only at a level of the fifth, sixth, and seventh cartilages, just to the left of their articulation with the sternum, can the pericardium be opened without injury to the pleura, but the resection of one or two ribs in this small vicinity would give too small a territory to operate in. Podrez's choice of method, as practised in his case, is thus described: Beginning in the second left interspace, one and a half inches from the sternal margin, the incision extends as far as the midsternum, then descends in the median line as far as the level of the seventh costal cartilage: at this level it follows the seventh rib. The sternum is divided in half, and again at its upper limit, either with chisel, saw, or forceps, and if the periosteum on the posterior surface is pushed aside the pleura will remain intact. At times it is difficult to enter the pericardial cavity, on account of the distention

of the pleura with blood, or because of the aspiration of air and the foaming of blood.

History of Podrez's case is as follows: A girl, aged seventeen, shot herself in the chest with a 32-calibre pistol, was admitted two hours later to the hospital, greatly collapsed. All means of stimulation fruitless, pulse imperceptible, increased area of cardiac dulness, vague bruit; intellect preserved, skin cold, etc. On two occasions exploration of the wound with a probe was followed by flow of blood and temporary improvement. On the third day operation under ether; flap turned to the left; the heart vessels visible. The pericardium was washed with boric acid solution, and a rent one centimetre long of the right ventricle was disclosed. This rent was closed by muscular action, not cicatricial tissue. A search was made for the bullet by puncturing the heart with a needle ten times in different directions, but without result; nor did a bimanual palpation reveal its location. All these manipulations of the heart caused a peristaltic motion (Bode). The pericardium was drained at first by gauze, subsequently by tube, and healing was complete in three weeks. Following the operation there were signs of cardiac insufficiency, in the way of œdema of the extremities, and pulmonary œdema controlled by digitalis. The temperature fluctuated between 37° and 38° C.

Three months after the operation no subjective or objective phenomena of the heart, and the sphygmographic tracing of the pulse is normal. Two X-rays, with an anterior and posterior exposure of the chest, show the presence of the bullet in the cardiac region, moving with cardiac contractions; and as acupuncture did not reveal the presence of the ball in the heart wall, the author assumes it to be in the cavity. Six months have elapsed, and the patient reports being in excellent health.

(VI) Loison, following in the foot-steps of Fischer (1868), statistically renders observations published within the last thirty years on wounds of the heart, thus bringing this subject up to

date. Only such cases are reviewed as have been proven by autopsy or where surgical intervention was practised, except needle-wounds, where the rhythmical movements imparted to the needle left no doubt as to the diagnosis. The statistics are grouped (*a*) wounds by needles, (*b*) wounds by cutting and pointed weapons, (*c*) wounds by fire-arms, (*d*) wounds by rupture and laceration from thoracic contusions.

The needle-wounds numbered twenty-three. In six instances the needle penetrated the pericardium, three times the left ventricle, two times the right ventricle, once in the right ventricle and mitral valve, once in the right ventricle and the tricuspid valve, once in the right ventricle and the septum, and once in the right auricle. Of these twenty-three cases, nine were cured (39.1 per cent.). Infection was responsible for death in one instance, hæmorrhage in eight cases, and five cases no cause assigned.

In the ninety cases of wounds by cutting instruments the site of the heart wound was as follows: Right ventricle, 31 cases; left ventricle, 26 cases; right auricle, 6 cases; left auricle, 2 cases; intraventricular septum and the coronary vessels anteriorly, 6 cases; ventricle not specified, 3 cases; large vessels at the base, 3 cases; multiple wounds, 1 case. In forty-one cases (45 per cent.) one or the other pleura was injured; in twelve instances (13 per cent.) the lung was also injured. Five times the diaphragm was perforated, and on three occasions the arteries of the chest wall were injured in addition. Eleven cures are recorded (12.2 per cent.), a figure superior to that of Fischer (8 per cent.), considering that only such cases are considered as proven by autopsy *in vivo* or death. One case recovered spontaneously. Surgical intervention was resorted to sixteen times for primary lesions, and twice for secondary manifestations (pericarditis). Therefore one can say that primary interference has been favorable since the number of cures exceeds the number of deaths. As causes of death in the operative cases, we have one from peritonitis, due to an accessory lesion of the abdomen (Canali), one from a lesion to

the intraventricular septum (Parozanni), one independent cause (Durante), one adynamia (Tassi), one mitral insufficiency (Tassi), one traumatic anæmia (Delorme), one from sepsis (Lumniczer), and one from pericarditis (Cappelen). The causes of death without intervention were fifty-six, from internal hæmorrhage. Of these twenty-seven were intrapericardial and intrapleural, twenty-six were intrapericardial and three intrapleural. Twelve died from infection, two from cerebral hæmorrhage and hemiplegia, and one was executed.

The gunshot wounds number 110, and they differ from the stab-wounds in the greater frequency of concomitant injuries, and in many instances the lesions of the pericardium are indirect or secondary to the contusing force of the bullet which has spent its greater violence on the ribs or the surrounding viscera, and thus fragments of ribs and foreign bodies are often lodged in the heart wall, cavity, or its membranes.

But three cures are recorded, and these, thanks to operative interference. In one instance the pericardium was drained, once the pericardium was partially sutured and drainage of it and the pleura, and once pericarditis was the first indication for drainage. The mortality in these cases is 97 per cent.

Causes of Death.—Intrapericardial hæmorrhage, 10; intrapleural hæmorrhage, 3; intrapleural and intrapericardial, 40; hæmorrhage and shock, 8; infection, 2, 8, 20; asystole, 3; embolism and cerebral hæmorrhage, 1; contusion of spine and paraplegia, 3; independent causes, 4; unknown causes, 5.

That these cases also might be deemed fit for surgical interference may be gathered by the time of survival after injury: thus:

Twenty-nine lived less than one hour; 11, twenty-four hours; 15, one week; 23, one week to one month; 12, one month to one year; 5, several years.

Loison's statistics agree in the main with those of Fischer.

(VII) In this little book the authors, Professor Terrier, with

the assistance of Dr. E. Reymond, present a *résumé* of the literature on this subject up to the present time; they acknowledge themselves to be indebted especially to the contributions of the Russian surgeon, Voïnitch-Sianojentsky, in the accomplishment of their work. The first seventy pages are devoted to anatomical considerations, under the two chief headings of anatomy of the precordial region, and topography of the interpleural space. The text is illustrated by numerous figures, and presents a clear and precise statement of the relations of the pericardium and its contents. Progressing to surgery proper, a chapter each is devoted to puncture of the pericardium and to incisions into the pericardium. The encouraging results attending these efforts are well shown by the statistics the authors are able to furnish at the close of the chapter on pericardotomy, where after stating that in cases of non-tuberculous suppurative pericarditis pericardotomy is especially indicated, they cite eighteen cases collected by Delorme and Mignon, and twenty by Voïnitch, with 60 per cent. of recoveries. In this connection they emphasize the importance of making a wide and permanent opening of escape for the pericardial effusions. The surgery of the heart proper is limited to the consideration of wounds. The cases of Farina, Rehn, Cappelen, and Parozzani find quotation here, the later observations noted in the preceding paragraphs of the present article, of course, were not available for reference when the book was prepared. The work as a whole forms a concise and satisfactory handbook for guidance in the appalling and urgent conditions to the discussion of which it is devoted.

MARTIN W. WARE.

INDEX TO SURGICAL PROGRESS.

ABDOMEN.

I. Colostomy with the Formation of a Sphincter from the Left Rectus Abdominis Muscle. By PROFESSOR VON HACKER (Innsbruck). Where colostomy is resorted to for inoperable carcinoma the aim should be to secure as much continence as possible. Torsion of the proximal segment of bowel, 180 to 360 degrees (Gersuny), accomplishes this in artificial anus sacralis or the proximal loop can be sharply bent and drawn through several layers of muscles or across the crest of the ilium or through an opening in the ilium. But now that colostomy (Littre), performed according to Maydl's method, *en deux temps*, is the method of choice, these procedures are not applicable. Frank therefore suggested, analogous to his method of gastrotomy, to fasten a loop of intestine to the peritoneum and draw it subcutaneously some distance, again to appear on the surface at a remoter point. Roux passes a loop of intestine through a U-shaped groove in the symphysis to insure a firmer hold of the bandage. Lauenstein permitted a long coil of intestine to protrude from the abdomen like a penis in order to control it. Witzel applied the principle of von Hacker, so serviceable in gastrotomy. In laparotomy through the fibres of the rectus the mesentery is ligated, the afferent bowel fastened in the upper angle, the efferent bowel in the lower angle, and the intervening skin sutured. Subsequently Witzel laparotomized close to the left of the median line and sewed the closely applied coils of intestine to the peritoneum and fascia. The rectus is then split into an anterior and posterior half, the bowel then dragged through this interval, making its exit through a button-hole in the skin at

the lateral margin of the left rectus, where it was anchored and divided on the sixth day with the Paquelin cautery.

A continence akin to that insured by the sphincter ani cannot be expected, for in the rectum the plica transversalis and the ampullæ are accessories for harboring the fæces subsequently to be evacuated, whereas in an artificial anus any pressure against a column of fæces results in immediate evacuation. An ampulla artificially produced by contraction of the orifice would cause colicky pains and even be in danger of rupturing the bowel. Von Hacker has modified the procedure of Witzel as follows: First, the usual incision for anterior colostomy, to ascertain whether the length of the mesentery will permit operation and at the same time to gain an insight into the local conditions. The inner angle of the incision reaches as far as the lateral margin of the rectus, where the loop of intestine is sewed to the peritoneum and fascia. The rectus is split into an anterior and a posterior half; through this gap the loop previously slightly twisted is passed as far as the mesial border of the rectus. The skin is incised at a corresponding point, and the coil passed through it and supported on a rod. The first wound is then sutured layer for layer.

The histories of three cases are appended. Two were operated typically. In a third case the mesentery was so short that the muscle had to be divided into a right and left half. One case controlled for one and three-quarters years with perfect result.

The object of the operation is to effect a better, if not an absolute, control, and as this can be accomplished without any increase of risk from the additional steps of the operation, it is commendable.—*Beiträge zur klinischen Chirurgie*, Band xxiii, Heft 3.

MARTIN W. WARE (New York).

CHEST.

I. Surgical Intervention in Lesions of the Posterior Mediastinum. By P. I. STOYANOV (Bulgaria). The author gives the credit of first advocating the opening of the posterior

mediastinum to the Russian Nassilow. This observer, on the basis of experimentation upon the cadaver, determined that foreign bodies in the upper portion of the œsophagus or tumors situated there could be most readily reached by resection of from the third to the sixth rib on the left side, and the removal of the lower ribs upon the right side for reaching the lower portion of the œsophagus. Stoyanov reports twelve cases operated upon for acute phlegmonous inflammation of the posterior mediastinum, due to tubercular disease of the vertebral column, one case of mediastinal tuberculosis, originating in the sternum, one case each of carcinoma, cicatricial stenosis, and foreign body of the œsophagus. In five cases the pleura was injured; three cases died as a result of the operation; seven were cured; in six the result is not mentioned.—*Revue de Chirurgie*, March, 1899, p. 388.

RUSSELL S. FOWLER (New York).

REVIEWS OF BOOKS.

TRAITE DE CHIRURGIE D'URGENCE. Par FELIX LEJARS, professeur agrégé à la Faculté de Médecine de Paris. 1 volume gr. in-8°. 760 pages, 482 figures. Paris: Masson et Cie, 1899.

Treatise on the Surgery of Emergencies.

This is an attractive book, not only by the field which it covers and the ability displayed by the author in working out his scheme, but also by the typographical setting in which it is presented. The paper is good, the type is large and distinct, the margins are broad, and the illustrations are abundant and clear, by far the great majority of them being original drawings from the subject, or half-tone photographic reproductions.

The aim of the book, according to the author, is to set forth in an essentially practical form and spirit the indications and the operative technique of the principal operations of emergency, to show what is necessary to do, and how to do it. The field is a large one, and an inspection of the book shows that thoroughness and judgment have been used in the selection and treatment of the points to be presented.

The different regions of the body constitute the framework of the treatise, the head, the neck, the thorax, the abdomen, the genito-urinary organs, the rectum and anus, and the limbs form the succession of themes treated; traumatisms naturally form the great bulk of the indications, but surgical emergencies of other origin are not overlooked, such as foreign bodies in the respiratory and intestinal canals; suppurative conditions of the middle ear and the mastoid cells, of the pleura, of the appendix, of the pelvis, of the peritoneum; ruptured tubal pregnancy, intestinal

occlusion, and strangulated hernia of every variety; retention of urine. To fractures and dislocations considerable space is devoted. An example or two will show that the author belongs to the most advanced school of surgeons in dealing with these injuries. Here is what he says about the treatment of fractures of the olecranon:

"The suture is the treatment of choice; this properly applied, and followed by sufficiently early mobilization, gives the best functional results. Let us apply the suture whenever we can in conscience do so.

"The other method of treatment is by massage, immediate massage, without any attempt at immobilization or of coaptation. It also gives excellent results especially in cases in which the separation is slight and the periolecranon fibrous investment is in part preserved. *There is no other course to take* [our italics, Reviewer]. Do not seek to bring the fragments together by this or that bandage, more or less complicated; cease the further discussion of the respective advantages of immobilization in flexion or in extension; do not immobilize" (p. 679). So also in speaking of fracture of the patella, he says:

"Massage or suture, these are to-day the only methods for treating fractures of the patella. Direct reunion of the fragments, followed by early mobilization, is the method of choice, to which recourse should be had whenever possible. Mark out a skin-flap, which, when raised, will expose the surface of the patella and the seat of fracture. Take away the clots and clean out the blood which fills the prepatellar bursa; separate the fragments and, in turn, cleanse the articular cavity. This first step is of prime importance, and on this account all the methods of subcutaneous suture should be resolutely banished; the operation should (1) cleanse and empty the knee-joint; (2) restore the patella" (p. 690).

In the matter of appendicitis, the author takes advanced ground, almost equal to that occupied by the most advanced of American surgeons. In beginning his discussion he propounds

as a principle, in his opinion firmly established, that every case of appendicitis should be subjected to operation; as to the time of the operation only is there room for difference of opinion; in the majority of cases the operation will be a matter of immediate urgency; in some it will be done later, at convenience. Then follows a discussion of the various forms in which the disease is met with; the occurrence of the benign forms are not concealed, and the propriety of delay in such cases acknowledged; the difficulties of forming an accurate opinion in certain cases are stated, and the final conclusion expressed thus: "When in doubt, operate!"

The tone of the book is didactic and somewhat dogmatic. The author has a breezy, sketchy way of rapidly outlining the emergencies of which he treats, and a positive way of describing what ought to be done, and how to do it, that makes very good reading. His teachings are up to date, and are based upon the tenets of aseptic surgery, some practical directions as to the requirements of which are given in the first pages of the book under the title, "*Le Matériel et l'Opération d'Urgence.*"

LEWIS S. PILCHER.

CORRESPONDENCE.

OPERATIVE TREATMENT OF HYPOSPADIAS.

To the Editor of ANNALS OF SURGERY:

SIR,—While it is certainly gratifying to see one's method favorably commended in such a journal as the ANNALS, it is depressing for the inventor to see this done under a false flag (see ANNALS OF SURGERY, June, 1899, p. 780, "On Operative Treatment of Glandular Hypospadias, by Professor von Hacker, of Innsbruck").

If you will kindly look at the report of the German Medical Society of October 4, 1897, a whole year before Herr von Hacker's publication,—which is contained in the November issue of the *New Yorker medicinische Monatsschrift*,—and in the *New York Medical Journal*, January 29, 1898, which illustrates my method, you will find that Herr von Hacker has tried to usurp my rights. How successful he was in his attempt is best proven by your review.

I would like to see what an Austrian professor would say, if an American surgeon should do such a thing for him.

CARL BECK.

NEW YORK, July 22, 1899.

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ANNALS OF SURGERY,

716 Filbert St., Philadelphia

FORCIBLE CORRECTION OF THE ANGULAR
DEFORMITY RESULTING FROM
SPINAL CARIES.¹

BY EDWARD H. BRADFORD, M.D.,

AND

ROBERT H. VOSE, M.D.,

OF BOSTON.

THE plan of straightening the curve in Pott's disease by force has been now sufficiently before the medical profession, with renewed attention in the past few years, to justify an attempt at a critical survey of the procedure, and it is proper that it should be considered, both from a pathological and a clinical point of view.

If the subject be looked at from a pathological point of view, it would seem as if the clinical application of the method would be limited to certain conditions. The curvature in Pott's disease, like every other affection, varies in the stages of its development. In cases of complete osseous ankylosis (as in cured cases of Pott's disease where recovery has taken place, except as far as deformity is concerned), it would seem to be unsurgical to attempt to straighten it. The proposal to make a wedge-shaped resection of the spinal column not being sufficiently reasonable to warrant acceptance.

The other conditions of Pott's disease vary from that of commencement of inflammation with a small carious focus to a large and extensive destruction of the bone, varying also with the extent of the ossifying osteitis, and its preponderance over the destructive osteitis. Where the ossifying oste-

¹ Read by title at the meeting of the American Orthopædic Association.

itis is more extensive than the destructive osteitis, operative methods become proportionately less desirable than where the destructive osteitis leaves the spine more movable.

The existence or absence of an abscess is also of importance. Where the front of the spine is surrounded by suppuration, it is manifest that ill-considered forcible straightening would be followed by danger.

It would, therefore, be inferred that in certain instances a rectification would be unjustifiable; in certain cases, it would be attended with danger; in others, the relief of the superimposed pressure or force crowding inflamed bony tissues together would be followed by relief. That this represents the actual results from the procedure of straightening of the spinal column is shown by the accompanying statistics, compiled by Dr. Vose.

ANALYSIS OF SIX HUNDRED AND TEN CASES REPORTED BY
TWENTY-NINE OPERATORS.

Length of time elapsed.

Varies from two days to two and a half years.

In separately detailed cases.

7 were more than one year old.

35 were more than six months old.

25 were more than three months old.

20 were less than three months old.

Deaths reported.

From all causes	21
Meningitis	5
General tuberculosis	4
Trauma of the operation	4
Intercurrent disease	3
Unstated	5

Autopsies.

All showed a considerable local trauma.

No case showed effectual effort at repair.

(One being two and a half years subsequent to correction.)

Immediate dangers.

Respiratory embarrassment	7 cases.
Pain	6 "
Shock (severe)	2 "

Indirect effect.

Abscess.

Reported present before the operation	18 cases.
Ruptured	4 "
Benefited or absorbed	5 "
Appeared subsequently	2 "

Paralysis.

Present before the operation	31 cases.
Relieved (complete or partial)	17 "
Not relieved	2 "
(Not stated)	8 "
Appeared (partial only)	4 "

General condition.

Reported distinctly improved	7 "
--	-----

Direct effect on deformity.

At time of operation, stated in	229 cases.
Complete correction	119 "
Incomplete correction	94 "
No gain	16 "
Result three months later (cases with some gain)	67 "
No relapse	17 "
Some relapse	44 "
Total relapse	5 "

Two questions suggest themselves; the first, how much force is needed in this procedure, and, second, the best means of applying the force. The amount of force required depends upon what is attempted. If it is desired to break up any ossification a great deal of force would be necessary; where the amount of cicatrizing osteitis is slight, slight force is required. It is manifest that the less force, the less the danger; as also the less force, the less the discomfort which the patient suffers. When the power is used to a mechanical advantage, less will be needed for the required correction. It is for this reason that the plan which has been in use at the Boston Children's Hospital for the past two years will be found to have certain advantages. In this but little force is employed, and that well under control. The diseased projection is used as the resistant point, and the weight of the trunk on each side of this acts as a straightening force. The appliance by which this correction can be done is as follows: An upright which can be raised or

lowered by an adjustable screw is furnished with a steel top having tips so arranged as to steady a zinc plate equipped with holes, arranged so as to press at each side of the vertebral spines. If these plates are padded and placed beneath the patient in such a way that they will lie on each side of the spines, at the point of the projection, an upward pressure can be exerted by raising the upright by means of the screw attachment. If this is raised to such a height that the head and pelvis hang from a suspended trunk, it is manifest that a strong force is exerted to straighten the spine and correct the curve. This can be increased, if necessary, by a traction force upon the limbs or upon the head and shoulders. Such a force, however, will not be

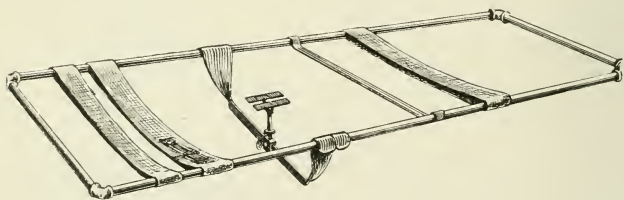


FIG. 1.—Frame for correction of kyphotic curve.

needed unless great violence should be required, which seems never justifiable. The amount of force is regulated by the amount by which the upright is raised. This method was first suggested by Dr. Metzger, an interne of the Children's Hospital. It was subsequently modified by Dr. Goldthwait, who placed steel bars to lie close to the spine as a means of correcting lordosis, and attached the upright to an oblong frame, using cross-bars and straps as a support for the trunk. This method he employed with great success. The unusually successful cases reported by Dr. Goldthwait before the Orthopaedic Association warrant the assertion that the method is equally successful as that requiring the employment of great force. It will be found that the patient suffers but little discomfort; that the jacket can be applied readily, and in prac-

tice no anæsthetic is used, as it has been found that sufficient force can be applied without discomfort, and it is believed that force greater than this would be dangerous. When the disease is seated in the upper dorsal region, it is manifest that some head-support is required, and this can be furnished by placing a stiffened leather collar, padded with felt, about the neck, and including this in the plaster jacket, which passes above the shoulder. Instead of this the various forms of head-support can be applied to the jacket, or the whole head may be included in the plaster bandage where mechanical appliances cannot be readily retained. It is advisable that where this method is employed repeated jackets should be applied, and a gradual correction be obtained in preference to the employment of a great deal of force at one sitting. The amount of correction obtained at each sitting, or after a number of sittings, will depend necessarily upon the pathological conditions, the complete straightening being possible but not practicable in all cases.

It is evident that no less importance is to be placed upon the retention of a corrected spine than upon the correction itself, for where a cure depends upon a cicatricial osteitis solidifying the weakened and inflamed tissues which have replaced the normal bone, the tendency to a contraction of cicatrizing tissues before ossification has taken place will tend to reproduce the curve even if thoroughly corrected. As the process of ossification of cicatrizing osteitis is not a rapid one, it is manifest that protection and retention will be required for some time, and the problem of the proper appliance is not a simple one, as the apparatus must be worn for months and even years. A discussion as to the proper apparatus for after-treatment is not the object of this paper. It can be said, however, that nothing is equal to a properly applied plaster jacket in the stages following correction. In the subsequent years other appliances, removable jackets, or apparatus are manifestly preferable. It will, therefore, appear that the use of forcible correction in Pott's disease is somewhat more limited than was at first supposed; first, by the

judicious selection of cases, and, second, by the number of cases where the after-treatment can be properly carried out, for it is manifestly absurd to straighten a spinal column, exposing the patient to a certain amount of risk, and, later, to allow the patient to relapse into a condition as bad as before the operation. The directions for the selection of cases given by various writers on the subject would seem to be judicious. It is manifest from the cases reported by Goldthwait that improvement in paralysis in properly selected cases follows this procedure, and it is believed it can be done without danger provided ordinary judgment is used. It is believed that the method herein described diminishes the danger.

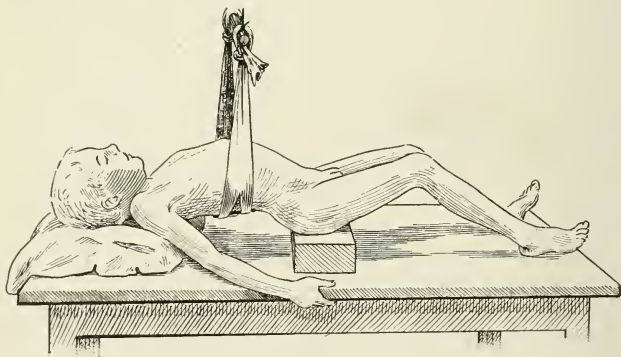


FIG. 2.—Sling for correction of kyphotic curve.

It would appear, therefore, that in the management of a case of caries of the spine, the surgeon, if the patient is presented in an early stage, can prevent the development of the deformity in the region below the upper dorsal, that where a curve has taken place in this region correction can be made with safety unless the cicatrizing osteitis has developed to a point where great force is necessary and a practical fracture of the spine required.

It is believed that no anæsthetic is necessary, if cases where the procedure is likely to be beneficial are the ones

subjected to the treatment. It is clear that by judicious after-treatment a relapse of the curve can be prevented in many instances, but this after-treatment requires attention for years.

A simpler and no less efficient way of straightening a curved spine, where the method is applicable, may be described as follows: The patient is placed on its back on any table. A cloth made of sufficiently firm cloth and a few inches in width is passed under the child at the greatest prominence of the projection. Between this and the skin a thick layer of saddler's felt is placed (a hole can be cut out in the felt or later in the jacket to protect the spinous processes). This sling should pass upward on both sides of the patient, reaching to a cross-bar, similar to that used in the ordinary Sayre suspension, and sufficiently wide to keep the ends of the sling from crowding the patient's ribs. The cross-bar can be attached to a pulley above the patient, and by raising the cross-bar, the patient is raised at the point at which it is desirable that the projection should be corrected. The patient can be raised, so that the weight of the whole trunk acts as a correcting force, and if necessary downward pressure or a downward pull can be exerted upon the pelvis and upon the shoulders or downward traction on the arms, head, and shoulders, and in this way all requisite force may be used. If the patient is raised partially from the table, and a pillow or sand-bag placed under the head, the trunk will be found sufficiently raised to enable the surgeon to apply plaster rollers in the ordinary way. The plaster bandages can be applied around the sling, and the sling cut off at the place of emergence of the bandages, leaving but a slight opening. This can be covered by an extra layer of bandage, making the jacket perfectly secure.

The advantages of this method are chiefly in its simplicity and its ready use without any complicated apparatus. In fact, a broom-stick or bar resting on two high pieces of furniture, and strong bandages or cloth as a sling, and a piece of felt would be all that would be necessary in the

application of a correcting plaster jacket by any surgeon of skill and experience.

It can be emphasized that it is the opinion of the writer that forcible correction of Pott's disease is a term which should not be applied to a method which can, if judiciously used in suitable cases, be efficient. No anæsthetic is necessary, in suitable cases, in a method which may be called the rectification of the curve of Pott's disease.

BLASTOMYCETIC DERMATITIS (PSEUDO-LUPUS
VULGARIS, SACCHAROMYCOSIS HOMI-
NIS, OR PSEUDO-EPITHELIOMA
WITH BLASTOMYCETES).

By JOHN E. OWENS, M.D.,

DANIEL N. EISENDRATH, M.D.,

AND

MR. C. F. W. READY,

OF CHICAGO.

SINCE the subject of the relation of blastomycetes to neoplasms and to certain affections of the skin described under different names—*e.g.*, blastomycetic dermatitis, pseudo-lupus vulgaris, saccharomycosis hominis, and pseudo-epithelioma with blastomycetes—has attracted considerable attention during the past five years, we have thought it would be of interest to report the following case of blastomycetic dermatitis in addition to the seven already published:

A widow, aged thirty-eight, came under treatment in the Surgical Department at St. Luke's Hospital, Chicago, in April, 1899, for an ulcer eight by four inches, situated on the antero-internal lateral aspect of the lower third of the left thigh. Four years previous to this date, in the locality named, there first appeared a circumscribed elevation somewhat painful, presenting an irregular surface, the skin being of the normal color. In about a week the growth spontaneously opening discharged a thin yellowish fluid. In the first part of the following month the top melted away, and seven months later the ulcer was the size of a hen's egg. On squeezing, short, worm-like bodies, the thickness of a hair-pin, appeared on the surface. In the early stages

the ulcer, if undisturbed by treatment, scabbed over, but soon reopened. This was repeated until the patient was subjected to treatment, previous to her admission to St. Luke's Hospital.

The treatment referred to consisted of solutions and ointments for two years, a pencil of caustic (probably nitrate of silver) was applied to the edges for two weeks, and electricity during July, 1898. At this time the ulcer was three by four inches, and in another month it increased a half inch throughout its whole circumference. Electric needles were next employed, and finally the mixed toxines for six months with the usual reaction. The ulcer had slowly and uniformly increased in size until the date of its removal.

The thoracic, gastro-intestinal, and the genito-urinary organs seem to be normal. Although fairly well nourished, the patient states that there has been a loss of weight during the past four years.

April 29, 1899, the ulcer was removed by clean dissection, and although it had existed for four years the subcutaneous tissues did not appear to be in the least involved, and there was no enlargement of the glands in the groin or saphenous opening. The margins of the ulcer were uniformly but abruptly elevated; one cicatrix, the size of a five-cent piece, and a number of smaller ones marked the surface. The progress of the ulcer has been uniform and equal in all directions; its general appearance is seedy or coarsely granular within an area of three-quarters of an inch of the circumference; the more central portions appear scarry and denser; two portions are composed of granular tissue; the surface lacked the redness of normal granulation tissue.

As the disease progressed it seemed to creep under and to elevate the epidermis to the width of a line. The worm-like bodies described by the patient were doubtless papillary pustules.

The general appearance of the ulcer, with its various patches and cicatrization, was strongly suggestive of lupus. Both the patches of cicatrization and the absence of lymphatic involvement supported this diagnosis. Its borders, however, were not irregular, eaten, or inverted, and there was neither a diathesis or evidence of tuberculosis in any other locality. The sore was single. An ulcer four years old, without secondary adenopathy; not es-



FIG. 1.—Three-fifths natural size.

pecially fungoid or painful; not hæmorrhagic; exhibiting various cicatrices, could scarcely be called epithelioma.

The operation-wound healed with the aid of skin-grafts, and the patient was discharged from the hospital in July of this year.

The study of the specimen in the pathological laboratory of the hospital showed the following:

PATHOLOGICAL REPORT.

Macroscopic Appearance (see Fig. 1).—An area five inches wide by eight inches long, more or less elliptical in shape, surrounded by apparently normal skin. Rising abruptly to a height of one-eighth inch above the *niveau* of the skin is a band of papilla-like elevations, about three-fourths inch in width, which forms the edge of the affected area. These papillæ are densely packed together, and yet quite separate from each other, with flat or slightly rounded apices. The uppermost layer of the normal skin passes up to the apex of the outermost row of papillæ. Towards the centre they gradually decrease in height, the remainder of the area being at about the level of the surrounding skin.

The zone just inside the papillary band looks like slightly corrugated skin, and shows scattered through it whitish, scar-like areas from a pinhead to a quarter in size (the latter forming the centre of the entire area). The central zone shows, grouped around the above-mentioned larger cicatricial area, brownish-red spots varying in size from a dime to an area about the size and shape of the little finger, which are softer than the remainder, and section of which shows that this reddish color extends almost to the subcutaneous fat. Section through papillary zone shows also a sharp demarcation of the papillæ against the underlying fat.

Microscopic Appearance.—A section through the marginal zone, including the papillæ spoken of before and their underlying tissue, shows the most characteristic changes. Under low power the resemblance of the section to an epithelioma is most striking, as seen in Fig. 2. The structure of the papillæ themselves resembles somewhat that of a similar portion of a skin papilloma, but are much shorter; they show all the layers of the normal skin in most places, in a few only an ulcerated condition so that the rete Malpighii lies exposed, and is covered by *débris* and polynuclear leucocytes. From the lowermost layer of epithelium pro-

longations of the same take place downward as far as the subcutaneous adipose tissue. These prolongations are very irregular, connect with each other, many of them showing distinct cell-nests, and others form separate islands of epithelial cells. Beginning in the uppermost layers of the cutis, or subepidermic connective tissue of the papillæ, and filling almost the entire space between the above-spoken-of epithelial prolongations, there is a dense infiltration of the tissues with mono- and polynuclear leucocytes and inflammatory cells. There is no regular arrange-



FIG. 2.—*a*, Organism within giant-cell; *b*, inflammatory cells in cutis; *c*, epithelial prolongations with cell-nest.

ment of these cells, such as one would expect to find in tuberculosis. Scattered irregularly throughout this round-cell infiltration are a moderately large number of giant-cells with parietally situated nuclei. In this densely infiltrated tissue one sees here and there cross-sections of blood-vessels, showing no thickening nor hyperplasia of the endothelium, or, in fact, no pathological changes. The organisms can be seen most distinctly in sections stained with methylene blue. A very few are seen either

free or situated in giant-cells in the lowermost epithelial prolongations. The greater number are seen within the many giant-cells or lying free and surrounded with round-cells in the connective tissue between the epithelial down-growths. There is a sharp



FIG. 3.—Giant-cell showing budding, vacuolated organism.

demarcation between the subcutaneous fatty tissue and the affected skin.

Miliary abscesses, as described by other authors, are seen in the epithelial down-growths. Hektoen found the organisms only



FIG. 4.—Giant-cell showing double contoured organisms.

in the miliary abscesses in the epithelium, and always outside the cells. In our specimens there are but few miliary abscesses, and these contain only here and there organisms. The majority of the latter are found, as stated above, within giant-cells or lying

free in the connective tissue, surrounded by inflammatory cells. A very few are found within giant-cells (see Figs. 3-8) lying in

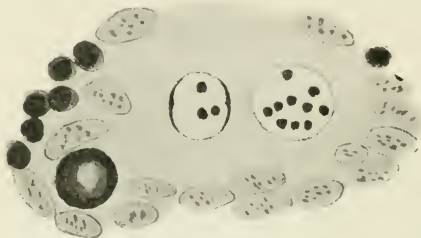


FIG. 5.—Giant-cell showing organisms apparently in sporulation stage.

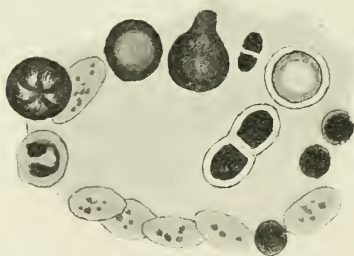


FIG. 6.—Giant-cells containing organisms in different stages of development.

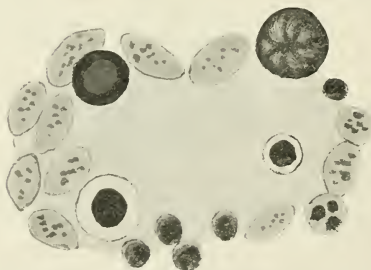


FIG. 7.—Giant-cells containing organisms in different stages of development.

the epithelial prolongations. They are best seen in the sections stained with methylene blue,—average about twelve microns in

diameter,—they are round or oval, have a distinct capsule, with an inner granular, deeply staining and an outer clear zone. Some can be seen in the act of budding, others show vacuoles, and still others small bodies like spores.

The result of the *bacteriological examination*, made by C. F. W. Ready, is as follows:

Immediately after the operation the specimen was received at the pathological laboratory; a small piece was excised from the granular portion near the margin of the growth, and this was then subcutaneously inoculated into a guinea-pig, under the usual aseptic precautions. Small pieces from different portions

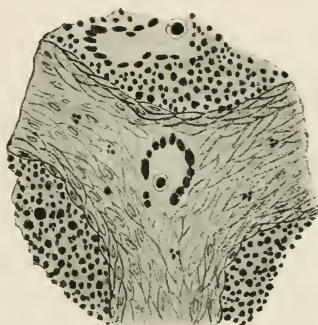


FIG. 8.—Giant-cells within epithelial proliferation and within miliary abscess, containing blastomycetes.

were removed for histological study. Smear preparations were also made, and stained according to different methods (methylene blue, Koch's method for tubercle bacilli, and Gram's method).

The microscopical examination of these slides showed large numbers of different varieties of bacteria, tubercle bacilli could not be found. Most of these cocci and bacilli retained Gram's stain, with the exception of a group of bacilli that closely resembled the colon variety.

For the following three days after the inoculation the guinea-pig proved quite sick, but after this period it seemed to recover. On about the eighth day there appeared a swelling at the site of

the inoculation incision; the animal became restless, and it showed evidence of being in pain. On the twelfth day the abscess ruptured spontaneously, and a creamy, viscid, foul-smelling material exuded, from which immediately glycerine agar and plain agar culture-tubes were inoculated, and incubated at 37° C. Smear preparations, treated in a similar manner as already mentioned above, showed the same organisms, but blastomycetes were not observed.

That the latter organisms could not be found in the pus is probably due to the fact of their close resemblance to certain leucocytes.

After thirty-six hours of incubation the cultures were examined. All of them showed rich growths that microscopically proved to consist of bacilli, cocci, and large, round, and oval bodies resembling yeast-cells.

It was not attempted to make plate-cultures; but an advantage was taken of Professor Ludwig Hektoen's observation that this blastomyces is capable of multiplying in a medium to which 1 per cent. or even slightly more of potassium iodide had been added. The result was as expected. The blastomycetes were in this manner obtained in pure culture, all the other bacteria being killed by the action of the potassium iodide. However, the blastomycetes did not altogether escape, being reduced in size, but this was overcome to some extent after a time by repeated transplantation on favorable media.

This blastomyces grows readily on all culture media, but best upon glycerine and glucose agar; it seems to grow equally well at room and blood temperature. Under anaërobic conditions no growth occurs. It forms roundish colonies, which are evenly granular with somewhat irregular outlines. Their color is of a light gray.

On glycerine agar slants it forms a smooth, light-gray or yellowish-gray layer, which spreads from the needle-track over the entire surface, and in older cultures the growth extends often between the tube wall and the medium.

On plain agar-agar the growth is not very extensive, and the color is usually more yellowish. Small pigment granules (first called attention to by Professor Hektoen) can be seen in preparations made from growths on this medium. They are absent in slides made from all other media.

The growth on glucose agar resembles that on glycerine agar.

In agar stab-cultures the growth occurs all along the needle-track, from which small, short branches, nodular in appearance, grow out irregularly. In gelatin liquefaction does not take place. On blood serum and on potatoes the organism grows fairly well; but if transplanted on these media, from bouillon cultures only a very slight growth is formed.

Litmus milk is not coagulated; neither is there a change in reaction.

Bouillon is at first almost clear with a slight grayish sediment at the bottom of the tube. After a time, however, cloudiness will be quite general, the sediment increasing. Glucose and lactose are not fermented, and the growth in glucose bouillon is rather limited.

The organism multiplies by budding, but Fig. 5 gives the impression that spore-formation also seems possible.

It stains well with all the ordinary aniline dyes; the best staining agent probably is a very weak aqueous solution of methylene blue. Stain for five to ten minutes, wash well in water, dry and mount. Sections previously stained with .5 per cent. aqueous eosin and then stained with .5 per cent. aqueous methylene blue, washed in water, dehydrated in absolute alcohol, cleared in xylol, etc., give excellent results.

The size of the organism varies considerably, and this depends greatly upon the media on which it is cultivated. Liquid media produce rather small forms that frequently form chains and groups, but one can also notice larger bodies scattered throughout the field, which gives the impression of having a mixed culture. It is explained by Professor Hektoen that these smaller forms are buds being detached from the mother cell, while still very minute; these will bud in their turn before the size of the mother cell is reached. (See Fig. 9.)

Size and shape also differ with the larger forms; round, oval, and rodlike bodies are seen. Some are vacuolated, others slightly granular, and most of them are surrounded by a shining membrane; the latter is especially well seen in sections.

The smaller organisms and the buds usually stain very deeply, the larger ones somewhat indifferently, and frequently irregularly.

The literature of the subject to this date will be found of more or less value.

In 1894, Busse¹ reported a case which he called *saccharomycosis hominis*. Patient, thirty-one years old, female, suffered from localized subperiosteal swelling of the left tibia. The abscess opened and many doubly contoured, refractive, round, and oval organisms were found which grew in all ordinary media. Inoculation experiments produced pathological lesions in animals. The organism produced fermentation in sugar solutions.

Several animals received inoculations from pure cultures, but these experiments are not yet concluded.

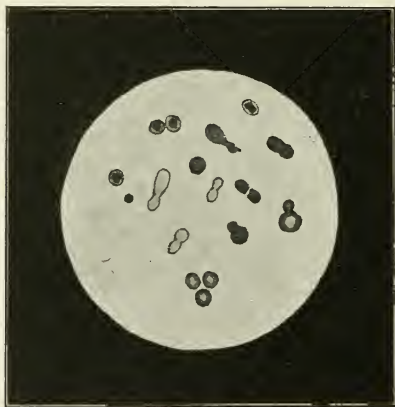


FIG. 9.—*Blastomycetes* (pure culture, glycerine agar).

In teased preparations many giant-cells were seen and the organisms lay together at times. In sections they stained well with methylene blue, carbol fuchsin, hæmatoxylin, and according to Gram's method. The periphery of the organism remained unstained. In sections treated with sodium hydrate they showed well as very refractive, doubly contoured bodies. The organisms were found in granulation tissue containing many giant-cells with parietal nuclei. Inoculated into the marrow of the tibia in rabbits, it spread over the entire marrow in three days.

Next the organism was inoculated in a dog subperiosteally,

producing a breaking down of the tissue and yielding a bloody discharge. Some of the pus inoculated into the peritoneal cavity of a rabbit produced a mild fibrinous peritonitis, and also hyperplasia of the mesenteric glands and severe hæmorrhages. The organisms were present in both cases. Reinoculation into a dog proved successful. Staphylococci and other bacteria were generally associated with blastomycetes. He was also able to produce cutaneous tumors in mice containing the blastomycetes. A small portion of the original tumor mass inoculated on ordinary media showed, in the first days, many small, white, often glassy-looking, somewhat raised colonies containing these organisms. On gelatine and agar the growth showed as a white layer; gelatine not liquefied. On blood serum the growth is almost crystal clear. The organism grew best on potatoes; in twenty-four hours, first a dirty white layer was seen, changing later to gray-brown. Double contours were usually not observed in cultures; the size varied greatly. The double contour was reobtained in animals resembling Darier-Wickham's cell inclosure in Paget's disease, but not coccidia, rather blastomycetes. The patient died soon after, the autopsy showing a granulation-tissue focus in the lung, foci in ulna, ribs, kidney, and spleen, in which the same organisms were found. This was probably the first recognized case of blastomycetic infection in a human being.

The first to observe a disease in animals produced by blastomycetes was Tokishige,² of Japan. He observed an endemic disease in horses, in which there is tumor-formation and ulceration similar to glanders; there was regional lymph-gland swelling, seldom any localization in the lungs or internal organs. More frequently there were abscesses in the testicles as a result of the extension of the disease by direct continuity from the skin. The animals died with symptoms of cachexia and anæmia. He found in the diseased area a large number of organisms which grew in cultures in a manner like oidia, but in the animal body more like a blastomyces. Animal experiments were not quite satisfactory. Similar epidemics have been observed in other countries.

Buschke² confirmed the observations of Busse, and produced in the latter's patient, experimentally, follicular acnei-

form nodules through inoculation, which became necrotic at the surface in five days, and contained only blastomycetes. He was also able to obtain the latter in pure culture from the blood before death.

The first case to be reported in this country was that of Gilchrist,³ in May, 1894, in which he had examined tissue from a case of Duhring, and found greatly hypertrophied epidermis throughout, with miliary abscesses containing blastomycetes.

Gilchrist and Stokes⁴ reported a second case of eleven and one-half years' duration, the disease having begun as a pimple, extending gradually, at the same time healing with white, slightly hypertrophic scar in the centre, requiring years. It began at the back of the left ear and gradually extended over the face. About one month after the first, a second lesion on the back of the hand appeared, a third on the scrotum, and a fourth on the thigh and leg. The diseased portion presented a sharp line of demarcation. In parts it had a firm papillomatous aspect, the largest size of pinhead. It destroyed the eyelids.

Microscopically it showed the following: Infiltration of leucocytes into corium. In miliary abscesses numbers of doubly contoured, refractive, round or oval bodies, only occasionally in giant-cells (latter infrequent). Cultures were successful, and showed refractive, oval, or round bodies, with a double contoured membrane. Observed budding by hanging drop. Grew best on glycerine agar and potato. No alcoholic fermentation or gas. In dogs inoculated with pure cultures, after two months' pleuro-pulmonary nodules, containing organisms microscopically and culturally. By reinoculation he produced miliary abscesses and tubercle-like nodules in animals similar to cutaneous lesions. Development of mycelium and distal and lateral cells or conidia and failure of organism to cause alcoholic fermentation have led them to classify the parasite as an oidium, and not blastomycetes or yeast-fungi. Growth of mycelium in cultures, and not in tissues, is not common.

Wells⁵ reported the third case in this country (and fourth altogether) of blastomycetic dermatitis. A man, forty years old, had an ulceration on the back of the hand for eleven years. During its progress the older portions would heal up, leaving a

poor substitute for skin of low resisting power. In appearance it was a raised fungated mass, of dark cherry-red color, sprinkled with cheesy, pinhead-size masses. It resisted all forms of treatment. Cultures showed only pus-cocci, and abscesses produced experimentally in animals showed the same. Microscopically sections of the tissue showed a great increase in the epithelial layer. Columns of epithelium were seen extending deeply into the corium, uniting masses of deeply situated epithelial cells to the superficial layers and to each other exactly as in carcinoma of the skin. This Malpighian layer is distinctly separated from the corium by the usual layer of cylindrical epithelial cells. Many leucocytes in spaces between cells and miliary abscesses, numerous in the epithelial masses. In these usually one or more parasites are found. In some of these are typical giant-cells. In the corium there was a great increase in the cells, in many places resembling granulation tissue. Giant-cells were very numerous in the corium, often in groups of three and four, identical with those of tuberculosis. Vacuoles were numerous. There were, however, none of the characteristic zones of tubercular foci about the giant-cells, which latter were scattered about with no apparent relation to the structure of the tissue in which they lay. No tubercle bacilli were found. The parasites were found chiefly in miliary abscesses, both of the corium and of the epithelium, and often free in the corium, never included in tissue or wandering cells. In structure they showed four chief parts from without inward,—(1) capsule; (2) transparent zone; (3) central protoplasmic portion; (4) a vacuole within protoplasm. Protoplasm stains with methylene blue or iron hæmatoxylin, but not by Gram's method, nor red by Gabbet's. Vacuoles not always present; are located centrally, and may be multiple. Budding described. Giant-cells produce no effect on the organisms they contain. Organisms in all stages of multiplication found within them.

In 1898, Dr. Robert Hessler,⁶ of Indianapolis, published, in the August number of the *Indiana Medical Journal*, a brief paper entitled "Blastomycetic Dermatitis: Report of a Case," in which an organism was found identical with that recognized by Gilchrist. In this fifth case, a healthy man received a slight abrasion at the hands of a barber, by whom he was being shaved, a red papule, as large as a grain of wheat, developing at the site of

the injury. This was a firm, elevated, and freely movable lesion, which, in three months, surrounded itself with a large coin-sized, elevated area, an accidental inflammation leading to suppuration of the original nodule, which had now attained the size of a pea. The organism present was found to be considerably smaller than that seen in the cases observed by Gilchrist and others, but is believed by Professor Welch, to whom were submitted samples of the growth, to be a blastomyces. In Hessler's case, the adoption of energetic antiseptic measures, as soon as the condition was recognized as calling for more than ordinary care, placed the organism under the most unfavorable conditions for development.

A sixth case, reported by Drs. Hyde, Hektoen, and Bevan,⁷ is as follows:

R. B., fifty-seven years of age, day-laborer, resident of Chicago and married, presented himself September 30, 1898. He was a native of Holland, and came to America in 1892. Mother and one brother, at forty-eight, died of consumption; three sisters also died of the disease. Patient had six children of his own, four living and in good health; two dead from causes unknown. He weighed ninety-nine pounds, a decline from his average weight of 146 pounds. He had been a heavy drinker. About five years ago a small reddish spot appeared on the right leg somewhat below the knee. This gradually extended until it covered practically the anterior surface of the limb, and developed into a tender, painful, and hæmorrhagic sore somewhat resembling an ulcer. Eventually, under treatment, healing occurred over the entire affected area, with the exception of a split-pea-sized patch on the inner aspect of the leg between the knee and the ankle. The result was the production over the region named, with the single exception of the unhealed patch, of a thin, broad, cicatrix-form tissue, quite superficial, insensitive, and in places scaling. Between one and two years ago the left thumb was found to be involved in a morbid process resembling that first seen upon the leg, a process which, by gradual extension from the site of original implication, produced a reddish patch well defined in outline, with a bluish-red areola and a decidedly verrucous aspect, covering the dorsal face of the left thumb quite as far as the nail-border, and also the dorsal surface of the left hand to a point somewhat above the line of the wrist. This was dull-reddish in

color, sharply defined in outline, having a peculiar bluish-red border, extending about four millimetres away from the edge of the affected area. Body of the patch was made up of an elevated mass of infiltration with a verruciform development of fine, pin-head-sized papillæ projected externally.

Dr. Bevan placed the patient on iodide of potassium, with the result that the sore on the leg healed, and such material diminution in the size of the patch on the hand occurred, with such marked amelioration of all the symptoms, that the question of operative interference was for the time set aside. Patient has had exacerbations of his trouble during the intervals when the iodide has been discontinued.

They say, "We know that the lesions of actinomycosis sometimes are relieved by the administration internally of iodide of potassium. In the light of the present experience, we now know that blastomycetic affections of the skin sometimes are thus benefited. There is suggested here an interesting possibility or probability that many of the cases heretofore grouped under the known and common forms of granulomata,—*i.e.*, syphilis and tuberculosis,—or cases mistaken for epithelioma and treated as such, are, in fact, due to as yet unknown or little known germ-forms, protozoa, yeast-fungi, or bacteria, and further investigation in this line may lead to the solving of the great problem of the etiology of malignant growths."

The surface of the skin is covered by an imperfect horny layer of varying thickness, and also by polymorphonuclear leucocytes. In places small abscesses have broken through the horny layer. The striking feature is the hyperplasia of the epithelium, in the form of variously shaped branching down-growths from the interpapillary processes. In many places the picture greatly resembles a squamous-celled carcinoma. Numerous focal collections of leucocytes and miliary abscesses are found in all parts of the epithelial proliferations; in these abscesses we find the organism peculiar to the process; some of the abscesses contain multinuclear giant-cells of the tuberculous type. The tissue between the epithelial down-growths presents acute and subacute inflammatory changes, but only few characteristic miliary abscesses.

The organisms are found only in the miliary abscesses, in the epithelium, and always outside of the cells; they are best

stained by methylene blue, and average twelve microns in diameter; they are round or oval, surrounded by a distinct capsule, from which the finely vacuolated or granular protoplasm is separated by a narrow clear zone.

A seventh case, of Professor J. B. Murphy and Dr. W. E. Coates, is quoted in the article of Hyde, Hektoen, and Bevan,⁷ as follows:

"Mrs. W., aged sixty-four, married. Four months previously a small papule appeared on the posterior surface of the lower third of the right leg; three or four days later a second appeared; gradually the two fused into a mass which slowly enlarged. In one month it was opened, a bloody fluid escaped, after which it slowly dried. There was a circular, elevated, cauliflower-like mass as large as a penny, with an irregularly ulcerated red surface. The growth was regarded as probably carcinomatous and removed.

"There was an ovoid raised area, five centimetres by four centimetres in the principal diameters, surrounded by a strip of healthy-looking skin from one to two centimetres wide, the under surface being composed of subcutaneous fat. The larger part of the nodule and the adjacent skin, from which the nodule gradually rises, are covered with a moderately thickened epithelial layer; part of the elevation is without any normal epithelial covering, and presents irregular, crater-shaped depressions. The elevation is due principally to a marked epithelial hyperplasia in the form of irregular, branching bands and masses as well as separate nests, the centres of which are generally more or less cornified. The histological resemblance to flat-celled carcinoma is often marked. In many places these epithelial proliferations consist largely of typical prickle-cells. Between the epithelial masses and bands is a very vascular and cellular connective tissue, the seat of a marked leucocytic and larger-cell infiltration; in some places there are focal accumulations of leucocytes constituting miliary abscesses. Similar miliary abscesses occur also in the centres of masses of epithelial cells. They contain in some instances one or two typical doubly contoured blastomycetes with granular and occasionally vacuolated protoplasm; distinct budding forms are present. Isolated organisms have also been found outside of the typical miliary abscesses, lying in the granulation tissue and usually surrounded by a few polymorphonuclear leuco-

cytes which seem to be gathering around the blastomycetes. In addition to the densely packed polymorphonuclear leucocytes, the miliary abscesses also contain cells with oval, vesicular nuclei, and occasional multinuclear giant-cells of tuberculous type. Some of the giant-cells contain typical organisms."

Buschke² divides blastomycetes into three groups:

(1) Those which are non-pathogenic, and are accidentally found in the secretions or on the surface of the body.

(2) Those which grow in the upper strata of the epithelium and give rise to catarrhal changes, erosions, and ulcerations,—*e.g.*, an angina (Troisier and Achalme⁸), and an obstinate uterine catarrh (Colpe⁹).

(3) Those which penetrate into the interior of the organism and cause phenomena in one of two ways: (*a*) By the production of a septicæmia, observed only experimentally.¹⁰ (*b*) By local changes in the tissue,—*e.g.*, a dermatitis.

In some animals the same cultures will produce a septicæmia; in others, a local skin process only.

Sanfelice¹⁰ isolated a variety of blastomycetes from the juice of fruit and from a sarcoma of an ox. Aruch and Fermi¹¹ described a disease of the skin occurring in animals similar to that of Tokishige's.

Corselli and Frisco¹² described a case of tumors of the omentum and chylous ascites in which pathogenic blastomycetes were found. This was probably a case of blastomycosis of the peritoneum.

Roncali described a similar case, in which there were tumor-like thickenings of the serosa, caused by deposition of blastomycetes and proliferation of endothelium.

Curtis,¹² of Lille, reported a case of skin blastomycosis with multiple ulcerating tumors of the skin in which the organisms were found. The course of experimental blastomycosis of the skin, as observed by Mafucci and Sirleo and Buschke in guinea-pigs, is as follows: A decided tumor develops at the point of inoculation which ulcerates, the ulcer gradually increases in size by the surrounding infiltrated tissue being broken down. These develop six days to three

weeks after infection. The animal dies in six weeks. The spleen is seen to be thickly set with tubercle-like nodules, composed of blastomycetes, round epithelioid cells, and occasional giant-cells. Similar nodules are found in the liver, lung, central nervous system, and other organs. Blastomycetes are found in the blood actively budding. In the skin the organisms are present in large number. Buschke reproduced in a guinea-pig the chylous ascites and tumor-formation in the omentum, observed clinically by Roncali, and resembling microscopically an endothelioma. Sanfelice contends that malignant tumors are caused by blastomycetes, but his views are not shared by many yet.

Mafucci and Sirleo are much less enthusiastic than other pathologists of the Italian school with regard to the part played by blastomycetes in the production of malignant tumors. They never obtained cultures from carcinoma or sarcoma that had been removed from the living and were not ulcerated. Their conclusions are as follows:

(1) *A priori* they consider malignant tumors infectious in origin.

(2) The infectious agent is not sufficiently determined, either through biological or experimental proofs.

(3) The search after the infectious agents of tumors should not be limited to one class of parasites.

(4) There are among the blastomycetes some with pathogenic properties.

(5) The processes produced by them do not resemble new growths of the nature of carcinoma or sarcoma.

(6) They produce septicæmia, suppuration, and chronic inflammatory processes of the nature of granulomata.

(7) The blastomycetes so far found in human carcinoma have, in animals predisposed to cancer, produced only ordinary inflammatory processes. They do not consider that Sanfelice's experiments on dogs prove the power of blastomycetes to produce epithelial new growths.

(8) The blastomycetes in carcinoma and sarcoma in man cannot always be demonstrated histologically or by culture.

(9) The blastomycetes are found in ulcerative malignant tumors in man.

(10) The distribution of the blastomycetes in tumors leads to the inference that an infection has been superadded.

(11) They do not exclude the possibility that blastomycetes may cause carcinoma or sarcoma, but do not believe that any experimental proof exists.

(12) They do not deny that protozoa can produce new growths. This is proved by the papilloma caused by the coccidium; but there is no experimental proof that they can cause carcinoma or sarcoma in animals susceptible to this disease.

BIBLIOGRAPHY.

- ¹ Virchow's Archiv, Band cxl, 1895.
- ² Sammelnschrift für klinische Vorträge, No. 218.
- ³ Johns Hopkins Hospital Reports, 1896, p. 269.
- ⁴ Journal of Experimental Medicine, Vol. iii, No. 1, 1898.
- ⁵ Journal of the American Medical Association, March 26, 1898.
- ⁶ Indiana Medical Journal, August, 1898.
- ⁷ British Journal of Dermatology, No. 129, Vol. ii.
- ⁸ Archives de Médecine expérimentale et d'Anatomie pathologique, 1893.
- ⁹ Archiv für Gynäkologie, Band xlvii, 1894.
- ¹⁰ Zeitschrift für Hygiene, Band xxi.
- ¹¹ Centralblatt für Bacteriologie, 1895, Band xvii, also 1895, Band xviii.
- ¹² Centralblatt für allgemeine Pathologie, Band vi and vii.

SOME REMARKS ON THE SYMPTOMS OF BRONCHOCELE AND THE RESULTS OF OPERATIVE TREATMENT.¹

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SIMPLE goitre usually commences as a small kernel-like mass in one or other of the lobes of the thyroid and gradually increases in size as the years go on. Sometimes both sides of the gland are affected and also the isthmus, but in this country, at any rate, the unilateral variety is the most common. This form is usually encysted, and the cysts may be multiple or single, and may contain clear or blood-stained fluid, or the contents may be solid or semisolid colloid material. A cyst which has suddenly become larger from hæmorrhage very often, when it is tense, simulates a solid growth. In addition to these two forms of goitre we have cases where the gland is uniformly enlarged,—the interstitial or parenchymatous form. This kind is seen chiefly in young girls, especially at the time of puberty, and generally disappears in a few months; it increases markedly before the menstrual periods, and is often, when not of the soft, vascular variety, benefited by the administration of thyroid extract and iodides. In all these forms of goitre the general health is apt to be affected, the patients are more or less nervous, are subject to breathlessness on exertion, owing to pressure of the growth on the trachea and sometimes tachycardia; in fact, patients having the encysted solid forms are subjects of a kind of pseudo-Graves's disease, produced by the growth. The

¹ Address delivered before the Montreal Medico-Chirurgical Society, June, 1899.



A case of solid colloid cyst, with symptoms of Graves's disease.



Colloid cyst after operation.

relief afforded by removal of the growth is often very marked, as the following case illustrates:

Mrs. H., widow, aged thirty-five, a telegraph-operator, consulted me December, 1894; is a delicate, highly nervous woman, with some exophthalmos; has had enlargement of her neck since childhood. "Seven years ago the growth suddenly enlarged, but the enlargement disappeared temporarily on application of an ointment. This increase was accompanied by palpitation of the heart and great nervous excitability; from that time the gland slowly enlarged, until last summer, when it grew much more rapidly. Of late she has had frequent attacks of tachycardia and is very nervous, so much so that she had to give up her occupation. She has great difficulty in breathing, especially when she has to exert herself. In this case the left lobe is the larger, but both lobes extend from the hyoid bone to the clavicle. The growth seems to consist of a number of cysts, fluid and solid." Operation was performed, and the patient got rapidly well; all nervousness and tachycardia disappeared, her eyes became normal, and she was able to resume her work.

I have many such cases in my note-book. Here we have symptoms produced by increase of thyroid tissue of the nature of Graves's disease, and perhaps pressure also has something to do with it. I have quite recently operated on a case sent me by Dr. Birkett, where pressure from enlargement of the right lobe of the thyroid caused contraction of the pupil on that side and well-marked ptosis. Operation in this case is too recent to state results, but when I last saw her, ten days after the operation, the ptosis was certainly less marked.

The symptoms of Graves's disease are familiar; the highly nervous, excitable individual, with prominent eyes, enlarged, soft, vascular thyroid, rapid pulse, tremors, and often pyrexia,—symptoms which may be produced by taking thyroid internally. Such cases are exactly the opposite of myxœdema, due to absence or loss of thyroid tissue. Here the patient is dull, sleepy, has a stupid expression of face, low pulse and body temperature, dry, thick skin, with loss of hair. The patient sits about stupidly idle and sleeping most of the day. One disease is the exact opposite of the other, the for-

mer due to too much thyroid and the latter to too little. The exactly opposite conditions in these two diseases seem to me to prove the theory that too much thyroid is the cause of all that group of symptoms called exophthalmic goitre or Graves's disease, and in the cases I have seen of Graves's disease, which commenced with enlargement of the thyroid, the severity of the symptoms increased *pari passu* with the continued enlargement of the gland. This tends to prove the theory that increase of thyroid tissue is followed by symptoms of Graves's disease, and when the increased tissue is removed, the patient's health, in many cases, returns to normal, the symptoms of Graves's disease gradually disappearing. The following case illustrates this:

Miss L., aged twenty, sent me by Dr. Cornell, of Brockville, Ontario, first noticed enlargement of the thyroid some years ago. Both sides were enlarged and the gland continued enlarging. A short time after the enlargement, nervous symptoms developed, such as tachycardia and tremors. These increased in severity so that on the slightest exertion her pulse was almost uncountable. Then came exophthalmos, with persistent pyrexia, and œdema of the lower extremities; there was also great difficulty in breathing, especially on exertion. When I saw her, in 1896, she was a pale, anæmic girl, very thin, with exophthalmos and a rapid pulse,—140 to 200. She was excessively nervous, had tremors, some fever, and œdema of the lower extremities. Both lobes of the gland were considerably enlarged; the enlargement, whilst on both sides, was not the usual vascular, spongy enlargement of Graves's disease, but seemed to be made up of a separate solid cyst in each lobe. I advised operation, which was performed November 18, 1896. I enucleated from each lobe, by separate incisions, a solid cyst, the size of a small orange, full of colloid matter. The patient rapidly recovered from the operation, and was sent home in about ten days much better. I had a letter from her doctor May 18, 1899, in which he says: "I am pleased to tell you she is in excellent health; the respiratory trouble is of the past; the exophthalmos, the tachycardia, the anæmia and pyrexia are no more present, and she is perfectly well."

In other cases, although the symptoms may not be marked, the relief from operation is almost as great.

Jennie R., aged twenty-four, has had, since she was fifteen years old, enlargement of the thyroid. It commenced as a small, round growth in the right side, and gradually grew to its present size. For some years, owing to tachycardia and breathlessness, she has not been able to walk any distance or to go upstairs; for some years has had exophthalmos. When I saw her, early in January of this year, she was an anæmic girl with prominent eyes, a very nervous manner, and rapid pulse. She had a very large swelling, which was round and smooth, extending from the sternum to the hyoid bone, and this swelling went under the sterno-mastoid. It was not fluctuating, soft, and did not appear to be vascular. I looked upon the case as one of large colloid cyst, and recommended operation. This was performed January 27, 1899, and the tumor, as expected, turned out to be a colloid cyst. Hæmorrhage was quite free, and a number of ligatures had to be applied, the superior thyroid being ligated. Recovery was complicated by a continuous high temperature (104° F.) and a very rapid pulse (180-200), following immediately on the operation. The discharges from the wound were tested and found perfectly sterile. It was supposed that this was a case of the so-called thyroid intoxication, which has been described by several writers. On giving free vent to the discharges from the wound, which were thin and watery, the temperature and pulse rapidly subsided, and the patient recovered completely. I heard from her on the 15th May. She says, "I have begun to feel like a different person, and just wonder how I ever put in such a miserable existence as I did the last five years. You would scarcely recognize me as the same person. My heart does not palpitate as it did before the operation."

I think these cases sufficiently prove that increase of thyroid tissue can produce a group of symptoms very much resembling Graves's disease. Now, these symptoms, in my experience, only come on in encysted cases with solid cysts. In cysts with fluid contents I have never seen them, so pressure can be but a small factor in the production of these symptoms.

In cases of true Graves's disease the improvement after operation is not so great. During the past four or five years I have operated on several cases, removing one-half of the enlarged thyroid. Although in these cases there has been

improvement, still it is not so rapid or so marked as in those cases where the disease in the gland is localized. In one of my recent cases, operated on in February last, the patient had all the chief symptoms of Graves's disease, such as tremors, tachycardia, pyrexia, etc., and a very large vascular thyroid. Operation relieved and her general health was much improved, but she writes me (May 23) that the nervousness still continues, though the tachycardia and exophthalmos are much better, and the remaining half of the gland is much smaller. In cases of true Graves's disease operation is not without danger. It seems that the danger is chiefly due to the anæsthetic; so much is this so that Kocher has given up general anæsthesia in these cases and resorts to local anæsthesia by cocaine. Even with local anæsthesia the operation is a dangerous one, and of Kocher's last fifteen cases of operation in Graves's disease two died.

It is my custom to advise operation in all rapidly growing goitres, especially if they be tumors of the solid form. If there be dyspnœa, the operation is urgently needed, but even if there be no dyspnœa, it is well to advise removal of those which are of recent formation and rapidly increasing in size, so that the serious train of symptoms which is characteristic of Graves's disease may be avoided.

Operative Procedures.—It is always well to be guided by the kind of case in choosing the form of operation. In the simple cystic case, where the cysts are large and not more than one or two in number, I invariably enucleate by the method I have described before (ANNALS OF SURGERY, Vol. xxii, p. 289), a simple incision over the cyst through skin and muscles down to the gland, tying the anterior jugular, if it be seen. When the gland is reached it is incised down to the bluish-white capsule of the cyst. The recognition of this capsule is most important, and when reached the cyst can be easily turned out. It has been my practice to open the cyst and evacuate its contents, so that it then can be pulled out of a small opening, and any vessels which bleed can be easily seized, as they are torn in separating the cyst. In some cases

of adherent cyst the separation is very difficult, but in fluid cysts the vascularity is not so great, nor is there so apt to be an adherent capsule. In the solid, colloid, encysted growths the enucleation is more difficult, owing to the greater vascularity. It is important here to get into the proper capsule, preferably the deeper one, for the superficial one is often covered with the ramifications of blood-vessels. Even in these cases before enucleating I open the tumor and remove some of its contents; where this is done the subsequent extraction is much less difficult. In diffuse cases or interstitial cases, and the true vascular thyroid of Graves's disease, in malignant disease, or where the cysts are multiple and small, or where the growth is very large, I prefer now to excise the gland. In Graves's and the interstitial cases only one lobe is excised. In these cases I make use of an incision down the inner border of the sterno-mastoid to near the upper border of the sternum, and then continue the incision transversely inward as far as necessary. Here the most important point is the free opening of the capsule of the gland. As soon as the capsule is divided the gland can be delivered, and the vessels tied without much difficulty. The superior thyroid artery should first be secured, then the gland thrown up and over to the opposite side. The inferior thyroid artery should be tied and not cut, and then the recurrent laryngeal nerve looked for and carefully separated. It runs up the posterior part of the gland; when the gland is enlarged it appears as if it entered it. The branches of the inferior thyroid artery with which it entwines should be cut near the gland, and also the veins which accompany these branches. I have cut the recurrent nerve once, and it was immediately sutured; the function has been partially recovered since.

The After-Treatment.—In the cases where enucleation has been performed there may be free oozing from the bed in which the cyst lay, and to prevent excessive oozing I pack this with strips of aseptic gauze, which I remove on the second day. In the cases where a portion of the gland has been removed a drain is inserted for twenty-four hours. The

wound is closed with horse-hair sutures and ordinary dry dressings applied. Usually the enucleation cases are discharged from hospital in a week or ten days.

The advantage of the enucleation method in suitable cases is the ease with which the operation is performed, the absence of risk of myxœdema, and the fact that the recurrent laryngeal nerve is never injured. The disadvantages are the chance of recurrence of the growth, and the tendency to oozing after operation; this oozing occasionally going on to secondary hæmorrhage. In nearly fifty cases of enucleation I have had recurrence in two,—in one on the opposite side, and in the other—a very small cyst—on the side that had previously been operated on. Both came to me, of their own accord, to have the cysts removed while they were small. Secondary hæmorrhage I have seen thrice,—once in a young man, who afterwards told me that he never had a tooth pulled without its bleeding for a week, and the other two were in women who had an apparent tendency to bleed. The blood oozed into the cavity which was left by the removal of the tumor, and only attracted notice when the breathing became difficult. In those cases the gauze had been removed too soon, for, after removal, on the second day there was a good deal of oozing. In such cases the gauze should have been replaced for another twenty-four hours.

Should secondary hæmorrhage occur, the wound should be laid open, the clots turned out, and the cavity firmly packed with sterile gauze. Swabbing out with tincture of the perchloride of iron, in the more severe cases, will arrest the hæmorrhage.

The cases I have seen, all recovered promptly, and the scar left did not appear to be any greater than that left after union by first intention.

I have seen many malignant cases, but have only operated on three. All subsequently died of recurrence of the disease in the lungs. Unless the tumor is removed very early there is little hope of permanent relief. In all the cases I have seen the gland had been enlarged for years before it took on a malignant action.

ON RESULTS OBTAINABLE IN THE TREAT-
MENT OF SOME POST-PARALYTIC
DEFORMITIES.¹

By JACOB TESCHNER, M.D.,

OF NEW YORK.

THE present paper is based on the results obtained in the treatment of six cases. These do not cover all post-paralytic conditions, nor do I claim that all similar cases would be benefited to the same extent as were those which I will report.

In the great majority of cases of paralysis from any cause, whether cerebral or spinal, when recovery takes place, it does so, after a longer or shorter period, with a more or less impaired condition of the affected member or members.

This impairment may be very slight; it may be severe enough to interfere with the proper performance of the functions of the member; it may totally disable it by lack of muscular power, or it may be disabled by deformities resulting from muscular contractions, with or without bone-changes.

Without going into theories and details of the recovery of certain groups of muscles,—the absence of recovery in some and the contraction of others,—I wish to direct attention especially to those muscles which have not recovered their power, and to those which have contracted.

In those cases where power to perform certain functions of a member seemed to be permanently lost, I have found that some muscles and portions of muscles would have the power to perform certain motions, if they had the assistance and co-ordination of other muscles and groups which seem entirely unable to respond to the will of the patient. These

¹ Read before the American Orthopædic Association, May, 1899.

helpless muscles would frequently give the reverse of a normal galvanic reaction,—*i.e.*, anodal closure greater than the cathodal closure, showing the degeneration of the fibres.

I have through careful study of the patient found the full limit of the functions of the afflicted member, and have, by various devices, succeeded in gradually enlarging the scope of voluntary motion of the limb to such an extent as to involve in voluntary motion those muscles which gave a degenerative reaction, and which formerly were not under the control of the will. This was effected by exercises which would compel the impaired muscles to act to their limits of strength and co-ordination, in supporting the action of those muscles and groups which were called into play by a given task.

I have from my experience been led to believe that a degenerative reaction in a muscle is evidence only that the greater part of the muscle has undergone a degenerative change; and that, notwithstanding that change, some normal fasciculi may remain, even were decided atrophy present.

If we can exercise these fasciculi, we can and do stimulate their growth to such a point that healthy muscular fibre will replace the degenerated tissue, and a normal reaction (CAC > ANC) will result, in addition to the power to render the muscles subservient to the will.

My theory of the regeneration of muscles is founded upon my observations of the behavior of the so-called degenerated muscles under the treatment to which I have subjected them.

Their voluntary action was obtained by induction,—*i.e.*, by their stimulation through the medium of associated muscles which were less impaired.

Where we have to deal with contractions sufficient to impede the full action of opposite muscles, a complete division by incision of either the muscles or their tendons should be effected. I have, in those cases where a tenotomy or a fasciotomy was done, insisted upon as full a use of the operated limb as the ability of the patient would permit at the end of *one week*. I consider the early use of the limb of the

greatest importance, and endeavor by that and other means to prevent a recontraction of the divided tissues.

Since it is not within the scope of this paper to enter into the consideration of the various pathological changes which occur after paralysis, nor to analyze the different hypotheses which the subject may give rise to, I shall content myself with citing the cases, their histories, their treatment, and the results.

CASE I.—*Right Obstetric Hemiplegia*.—October 12, 1896. Boy, aged five and a half years. The patient was born with an obstetric (right) hemiplegia, due to the application of forceps to the head to terminate an extremely difficult and tedious labor. He has undergone almost constant treatment by massage and electricity from the time of his birth until he was brought to me for an examination.

His condition is the following, viz.: There is a decided hemiatrophy of the entire right side of the body, including the arm, hand, leg, and foot, the face and the head. There is a lateral curvature of the spine, with a scoliosis in the left dorsal region. The left shoulder is considerably higher than the right, and the angle of the right scapula is very prominent. The patient cannot raise his right arm above his head, the right deltoid is markedly atrophied, and the right forearm is slightly flexed and pronated. The right hand is slightly clawed and hyperextended at the wrist. There is, however, no contraction. The ulnar side of the hand is most active in attempting to grasp an object, the thumb, index and middle fingers having very little power. Patient cannot slowly flex the forearm to such an extent as to bring the hand to the shoulder, but is enabled to do so by the impetus given to that member by a swing to the body. When the patient succeeds in attaining this position of the forearm, the hand is hyperextended so as to form a right angle with the forearm. An upward movement from this point to above the shoulder cannot be executed by the patient, owing to the atrophied condition of the deltoid. In an attempt to do so, he raises the entire right side of the body, the weight resting upon the left foot, the right heel being elevated, and the ball of the right foot lightly touching the floor. The patient walks with an outward swing of the right leg, the right foot being everted.

The patient was treated by gymnastics three times a week, from October 12, 1896, until January 10, 1897, with the exception of two intervals caused by illness; the first from October 21 to December 1 (forty days), and the second from December 20, 1896, to January 7, 1897 (eighteen days). During this entire period he had received fifteen treatments.

At the beginning of the treatment he was instructed in regular development-exercises with one-pound dumb-bells. He was taught to swing his right hand above the head, the arm being extended to the limit of his ability. When this was accomplished, he was taught to do the same exercise with a one-pound dumb-bell, then a two-pound bell, and gradually increasing the weight in hand and the number of times of executing this exercise.

As the patient could not extend the arm and hand from the shoulder to above the head, he was instructed to grasp my index-finger and attempt this motion. With some assistance (gently lifting) he could do this several times.

October 17, 1896.—Third treatment. Patient can extend the hand and arm from the shoulder to above the head without assistance, and can swing a three-pound bell to this position, without assistance, five times in succession.

October 21, 1896.—Patient can push a one-pound bell from the shoulder ten times, and can swing a five-pound bell to this position fifteen times in succession.

January 10, 1897 (the last of this series of treatments).—Patient is able to push a three-pound bell twenty times, and swing a ten-pound bell fifteen times. The father of the patient informs me that he is using his right hand well in many ways. He is able to button his jacket and trousers, and uses his fingers with a fair amount of deftness. His curvature has almost entirely disappeared; there is hardly any prominence of the angle of the right scapula, and the patient does not swing the right leg in walking. The general improvement is very marked. Discontinued treatment, to be resumed for a period in the fall.

October 5, 1897.—Patient returns for further treatment. General condition excellent. Has gained considerable strength and vigor. Says he uses his hand quite well, and, although left-handed, he writes and draws at times with his right hand.

October 30, 1897.—Twelfth and last treatment of second period. Patient swings a twelve-pound bell twenty-five times and



FIG. 1.—February 1, 1897.

CASE II.



FIG. 2.—April 10, 1897.



FIG. 3.—February 1, 1897.

CASE II.

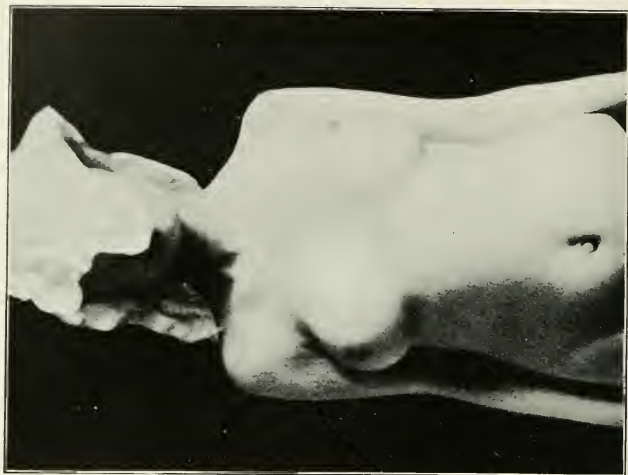


FIG. 4.—April 10, 1897.

pushes a seven-pound bell thirty times. Discontinued treatment; to be resumed in the spring.

February 1, 1898.—Treatment resumed.

March 5, 1898.—Eleventh treatment of third period. Patient swings a fifteen-pound bell twenty-five times and pushes an eight-pound bell thirty times.

March 7, 1899.—Patient again returns for additional treatment. He has been receiving piano instruction since the early fall, and is making rapid progress. There is no appreciable difference in his ability to functionate with either hand, although the left arm and hand are somewhat stronger than the right.

April 1, 1899.—Eleventh and last treatment of fourth period. Patient raises and pushes a bar weighing thirty-six pounds fifteen times overhead. He swings a twenty-pound bell twenty-five times and pushes a ten-pound bell seventy times.

CASE II.—*Cervical Poliomyelitis.*—January 27, 1897. Female, aged fourteen years. Patient had an attack of cervical poliomyelitis in October, 1895, which was followed by a severe neuritis, lasting six weeks. She has completely lost control of legs and arms. After about two months—*i.e.*, December, 1895—she began to use the lower extremities, tottering about and walking poorly. The right arm and hand also began to recover at about this time (December, 1895). The left, however, continued quite helpless, and has not improved since January, 1896, despite constant and vigorous treatment by massage and electricity. She comes for treatment for a severe curvature due to her paralysis.

She is emaciated, anæmic, and very weak. There is a severe paralytic S-curvature of the spine, with a large right dorsal scoliosis. (Figs. 1 and 3.) Patient can raise the right hand above the head, but it requires a considerable effort. She cannot raise the left hand above the waist-line. The strength of the right forearm, as tested by a dynamometer, is ten kilos, and the left is four kilos. There is marked atrophy of both upper extremities, and the atrophy of the hands gives them a decided skeletal appearance. (Fig. 5.)

The gait is awkward, jerky, and uncertain. There are no contractures, except the left sterno-mastoid and trapezius muscles, which, however, are slight.

Electrical examination shows degenerative reactions of the thenar and hypothenar eminences of the right hand,—*i.e.*, anodal

closure greater than the cathodal closure,—and in the left forearm and the left deltoid the anodal closure is equal to the cathodal. In the other muscles the reactions are normal.

She was accepted for experimental treatment to determine whether the impaired muscles could be so much improved that the arms could perform such work as would influence the curvature. Arrangements were made for three treatments per week for a period of two months.

January 30, 1897.—Treatment begins to-day. The patient is tested as to her ability to exercise, and finding it such that nothing can be accomplished in the ordinary way, I decided to begin with exercises of the upper extremities, with the patient in the recumbent posture. The following exercises were attempted, viz.:

(1) The flexion of the forearms to a perpendicular position and back to the horizontal by the side of the body, repeating several times.

(2) The swinging of the arm from the floor—the elbow extended—to a vertical position, sustaining it there, and returning to the original position. This exercise requires considerable assistance. Then the same exercise; continuing the arms from the perpendicular to the horizontal extended above the head, and return in the opposite direction to the floor, by the side of the body. This exercise requires more assistance.

(3) A sweeping motion outward, on the floor, of both arms from the sides of the body to full extension above the head.

(4) The closed hands are placed on the floor above the shoulders, and, remaining on the floor, are alternately extended beyond the head and returned.

(5) The closed hands are placed in front of the shoulders, and the arms are extended perpendicularly and alternately. The left is assisted by placing my index-finger into the hand, partly guiding and partly lifting the member to full extension.

These exercises can be better demonstrated than described.

February 1 and 3, 1897.—The same exercises were repeated.

February 8, 1897.—The same exercises were repeated with the following changes, viz.: Exercise 5 of January 30 was done, with a pound bell in each hand, thirty times without assistance. Patient did the same exercise (pushing) standing ten times with each hand. She was instructed to swing a three-pound bell from the

floor to above the head, and executed this movement twenty times with each hand.

March 1, 1897.—Patient informed me that she was able to resume violin practice, which requires considerable strength to hold the instrument level and simultaneously use the fingers of the left hand.



FIG. 5.—Case II, February 1, 1897.

April 10, 1897.—Patient has vastly improved. This is the last treatment contracted for, and the patient leaves for the country.

The scoliotic condition is much improved (Figs. 2 and 4) and so is the gait. Patient uses the left hand quite well. The strength of each forearm, as tested by the dynamometer, is fourteen kilos. Her exercises at this treatment were the regular series of small-

bell exercises, as described in my paper on "The Treatment of Postural Deformities of the Trunk by Means of Rapid and Thorough Physical Development" (ANNALS OF SURGERY, Philadelphia and London, August, 1895), with one-pound bells, pushing two eight-pound bells sixty times, pushing two five-pound bells one hundred times, swinging two ten-pound bells overhead ten times, and swinging one fifteen-pound bell overhead twenty-five times with each hand.

Electrical examination of the muscles, which gave abnormal reactions at the time of the first visit of the patient, revealed nothing abnormal, all cathodal closures being greater than the anodal.

The patient was advised to return for further treatment in October. During the fall of 1897 I was informed that the patient was doing so well, regarding her scoliosis, her gait, and the use of her hands, that her mother deemed the expense connected with further treatment unwarranted.

CASE III.—*Right Obstetric Hemiplegia*.—April 2, 1898. Boy, thirteen years old. Right obstetric hemiplegia due to forceps pressure. Patient is brought to me for a constantly increasing left dorsal scoliosis. There is a retarded development of the right upper and lower extremities, and both members show a poor circulation of the blood compared to those of the left side. He is mentally retarded and has a decidedly idiotic appearance. His speech is very slow, sputtering and muttering. He will not speak to adults, not even to his father or mother, but will do so to children, ranging from about six to ten years. The saliva is constantly dribbling from the angles of his mouth. His gait is tottering and unsteady. He has learned to read monosyllables, but does so very slowly. He apparently takes no interest in anything going on about him. He can add single numbers when the total does not reach above twenty. He has always had an attendant (for several years a man), because he was unable to care for himself in any way. He could not adjust any part of his clothing, nor could he button a garment with his right hand. If he were taken around the corner from his home, he could not find his way back unaided. He has been under constant treatment by massage, electricity, and light gymnastics since infancy. He has been under the care of several neurologists, and has spent some time at the Seguin Physiological School. For the past two years he has, by the advice of his physician, received ordinary gymnas-

tic training, and almost daily instruction in bicycle riding, with the result that he has recently learned to ride when placed upon a wheel, but he can neither mount nor dismount it. His wheel must be stopped and he must be taken off. Began a course of treatment by heavy gymnastics, to last two months. Patient is extremely awkward and very slow to comprehend what is required of him. He requires rough handling to make him understand and to awaken a response to a given order. He is utterly unable to keep his feet in a fixed position upon the floor, as requested while exercising, showing his inability to co-ordinate properly.

May 5, 1898.—Patient has been improving in his exercises. His posture is decidedly better, his footing is good, and there is a marked awakening of his mental faculties. He is quite communicative; and, fired by a patriotic spirit, he reads and relates to me war news from the early afternoon “extras.” He was now ordered to undress and dress himself without assistance. In this he succeeded, but was quite slow.

May 31, 1898.—This is the last treatment of the course contracted for. The patient was discharged, and was requested to return in October for further treatment. He was ordered to take mounting and dismounting lessons on his bicycle. About one week after his discharge, I met the patient, who informed me that he had thoroughly mastered the mounting and dismounting of his wheel in two lessons.

October 13, 1898.—Patient returned for another course of treatment to last two months. He is in excellent condition; is communicative and voluble, and, as a result of private summer instruction, reads well and is working at fractions in his arithmetic. He writes with his right hand, though not very well. He now associates with playmates of his own size and age, and talks freely with his parents and members of the household. He has now no attendant, as he is thoroughly able to help himself and find his way about the city. He has been driving a pair of spirited horses during the summer.

December 15, 1898.—Patient discharged from treatment in prime condition. His exercises to-day were as follows, viz.: Regular exercises with two-pound bells; raising a sixty-four-pound bar twenty times above the head, standing, and twenty times lying down; swinging one thirty-pound bell forty times overhead

with each hand; swinging two twenty-five-pound bells overhead twenty-five times with both hands; and pushing two twenty-five-pound bells fifty times alternately above the head.

The improvement in his physical condition is evident from the following table of measurements. The actual time of treatment was four months, extending over a period of eight months:

	April 2, 1898, beginning of treatment.	May 31, 1898, end of first period of treatment.	December 15, 1898, end of second pe- riod of treatment.
Weight	37.8 kilos	38.5	43.0
Height standing	148.7 C.	151.5	156.5
" sitting	74.6 C.	76.0	79.0
" of sternum	121.4 C.	125.5	129.0
Girth of head	50.0 C.	57.0	51.2
" neck	28.5 C.	29.5	30.5
" chest	65.0 C.	66.0	70.0
" " full	69.5 C.	73.0	76.0
" waist	65.0 C.	65.0	67.0
" hips	75.0 C.	75.0	79.0
" thigh	43.0 C.	43.5	44.5
" knee	32.0 C.	32.6	34.5
" calf	28.0 C.	29.5	30.5
" instep	22.5 C.	22.5	23.0
" upper arm	21.0 C.	23.5	25.5
" elbow	20.5 C.	20.2	20.0
" forearm	21.0 C.	22.5	23.0
" wrist	15.0 C.	15.0	15.5
Depth of chest	14.1 C.	15.8	15.9
" abdomen	15.5 C.	15.3	16.5
Breadth of head	14.4 C.	14.5	14.5
" neck	8.5 C.	9.1	10.0
" shoulders	32.3 C.	33.7	35.2
" waist	20.7 C.	23.8	22.5
" hips	25.7 C.	26.6	27.4
Length, horizontal . . .	150.0 C.	154.0	158.5
Stretch of arms	151.0 C.	154.8	161.5
Capacity of lungs	90.0 cu. ins.	120.0	140.0
Strength of back	35.0 kilos	75.0	90.0
" legs	50.0 kilos	100.0	110.0
" chest	10.0 kilos	14.0	20.0
" forearms	15.0 kilos	20.0	22.0
Total strength	110.0	209.0	242.0

I wish to direct special attention to the increases of the different measurements, the weight, the lung capacity, and the strength tests.



FIG. 6.

Photograph of cast of right foot,
taken December 24, 1898.

CASE IV.

FIG. 7.

Photograph of cast of right foot,
taken April 30, 1899.

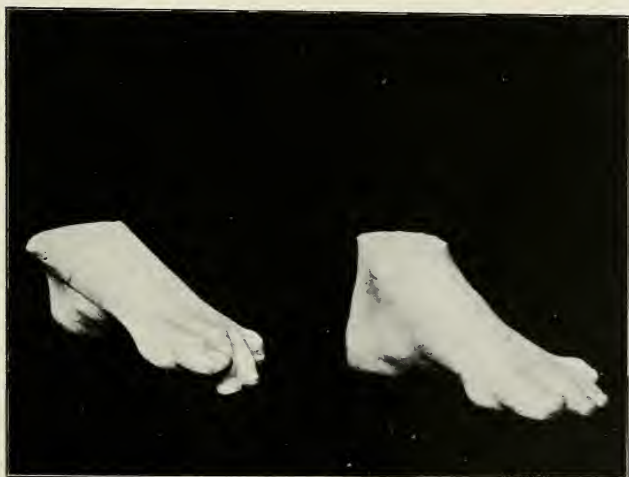


FIG. 8.

Photograph of cast of left foot, taken
December 24, 1898.

CASE IV.

FIG. 9.

Photograph of cast of left foot, taken
April 30, 1899.



FIG. 10.—January 22, 1899.

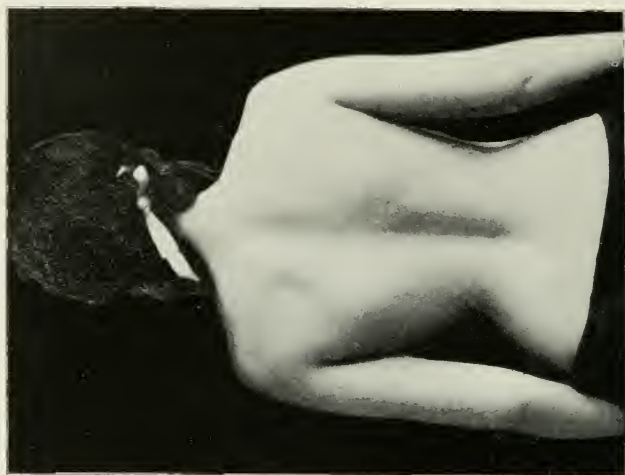


FIG. 11.—May 26, 1899.

CASE V.



FIG. 12.—January 22, 1899.

CASE V.



FIG. 13.—May 26, 1899.



FIG. 14.—Right hand, showing atrophy. CASE V. FIG. 15.—Left hand.
 Photograph of casts of hands taken February 10, 1899.



FIG. 17. CASE V. FIG. 18.
 Photograph of hands taken May 24, 1899, showing improvement as evidenced by
 growth and development of the right hand.

CASE IV.—*Poliomyelitis Anterior: Double Pes Cavus*.—December 18, 1898. Girl, aged twelve years. Patient had an attack of poliomyelitis when about five years of age, causing paralysis, which prevented her from walking for several weeks. She was treated by massage and electricity until the present time without benefit. About three years ago braces were applied, and were worn also for some time without benefit. Her parents believe that the contractions of the tendons became more evident during the time she wore the apparatus. During the past year she was subjected to the daily stretching of the plantar fasciæ and the heel tendons, without benefit. Last spring the operation of tenotomy and fasciotomy was advised against by one of our most prominent orthopædic surgeons.

The child walks very poorly, with very slight equinus; both feet inverted (pigeon-toed), the left more than the right. Both feet present the condition of cavus, with slight equinus. The angle of greatest flexion of both feet is 90 degrees. The tendons of the flexor longus digitorum, the flexor longus pollicis, the plantar fasciæ, and the heel-tendon of the right foot, and the same tendons and fascia, in addition to the tendon of the abductor pollicis of the left foot, can be distinctly felt as the hinderances to the reposition of the feet to their normal condition and to their full flexion. Patient has no power over the toes of either foot.

Electrical reactions show nothing abnormal, except that the flexors of the toes of both feet respond faintly to the faradic current, and not at all to the galvanic current. Both legs have a stick-like appearance from lack of development of the leg muscles. Advised operation as a preliminary to heavy gymnastic treatment.

December 24, 1898.—Made casts of feet. (Figs. 6 and 8.)

December 28, 1898.—Patient was operated upon under gas and oxygen anæsthesia. The plantar fascia, the tendons of the flexor longus pollicis, the flexor longus digitorum, the flexor brevis digitorum, and the gastrocnemius of each foot, and the abductor pollicis of the left foot were divided subcutaneously, the feet were forcibly manipulated and put in a plaster-of-Paris dressing in a flexed position.

January 4, 1899.—One week after operation the plaster dressings were removed, and the patient was put upon her feet and gently exercised, and instructed to attempt walking about the room without shoes.

January 9, 1899.—Patient still requires assistance in walking. Began treatment by heavy gymnastics. Patient is very unsteady and has a very poor footing. She is unable to throw her weight upon the forward part of her feet, and in walking pounds the floor with her heels.

January 30, 1899.—Patient progressed very nicely. She can raise and sustain herself upon her toes, walks with a fairly elastic gait, and performs her exercises with grace and precision.

April 30, 1899.—Casts of feet were taken to-day (Figs. 7 and 9) to compare with casts taken before treatment was commenced.

May 13, 1899.—Patient discharged cured, with the advice to continue light exercises.

CASE V.—*Right Obstetric Hemiplegia.*—*January 22, 1899.* Female, aged fourteen years. Patient has a decided rotary lateral curvature, presenting a right dorsal scoliosis and prominent left hip. Antero-posterior curvature is very marked; shoulders quite round, and right anterior portion of chest is quite prominent. (Figs. 10 and 12.) Patient walks with a hemiplegic gait,—i.e., a swinging outward of the right foot, which is everted. The gastrocnemius is contracted, preventing flexion of the foot beyond an angle of 90 degrees. For all practical purposes the right hand is useless. There is a hemiatrophy, or retarded development, of the entire right side of the body. The right forearm and hand are very much smaller than the left (Figs. 14 and 15); the fingers are shorter, thinner, and more tapering, and the nails are smaller and not as well shaped as upon the fingers of the left hand. The ring and little fingers are strongly flexed, and the first phalanges of all the fingers are slightly hyperextended, diminishing the normal prominence of the knuckles and the depressions between them, and the hand is flexed at the wrist. There is a wasting or lack of development of the interossei, and the thenar and hypothenar groups. These muscles give a degenerative reaction to the galvanic current. When the patient attempts any movement with the right hand, there are associated movements of the left hand. The patient has been under constant treatment, in excellent hands, by electricity and massage since infancy. For the past three years patient has, by advice of her physician, taken lessons on the piano, for the purpose of establishing independent action of the fingers. She has not succeeded in accomplishing anything because, when she attempted

to strike one key with one finger, the other fingers would sprawl over the other keys, all the fingers being extended.

For the past two years she has received the stretching treatment for the shortened gastrocnemius. Advised division of the heel-tendon of the right foot as a preliminary to gymnastic treatment for the improvement of the curvature and of the condition of the hand and foot.

February 8, 1899.—Divided the heel-tendon of the right foot subcutaneously, under nitrous oxide gas and oxygen anæsthesia, and applied plaster-of-Paris dressing, with the foot in a flexed position.

February 10, 1899.—Made plaster casts of both hands (Figs. 16 and 17) to show the difference in size, shape, etc.

February 15, 1899.—Removed plaster-of-Paris bandage, and proceeded with mild exercises, especially for the feet and legs.

February 16 to 26 (inclusive).—Continued daily exercises for the feet and legs.

February 27, 1899.—Treatment by heavy gymnastics was commenced. Patient could barely hold a two-pound bell in the right hand, the thumb, index, and middle fingers taking no apparent part in sustaining it.

March 22, 1899.—Patient has been receiving her treatments thrice weekly. She swings a fifteen-pound bell fifteen times overhead with the right hand, and in so doing all the fingers, including the thumb, are closely approximated to the handle of the bell.

The patient informed me that she had made great progress in her piano lessons, and says that she can use each finger independently in a well-rounded position; that she can play thirds and chords clearly and distinctly, and that her tone-production is very much improved. She also informed me that she has begun to use a knife at the table, and that she used it fairly well. She can adjust the hooks and buttons of garments and shoes, and finds her right hand quite useful in many ways. The patient was requested to attempt and to practise writing with the right hand for ten or fifteen minutes each day.

April 21, 1899.—The patient has progressed favorably. Her hand has improved in its contour; the knuckles appear more prominent, and the depressions between them are evident. This change is due to the re-establishment of the power of the inter-

osseï. She walks very well and has lost the outward swing of the right foot. She drags it slightly, however, when she is tired. Her posture is also very much improved, and her curvature is yielding to treatment. She did not begin to practise writing until yesterday.

May 24, 1899.—Patient has not practised writing with the desired regularity for the past five weeks, and often did not attempt it for a few days at a time. She finds less difficulty with a pencil than with a pen, as the latter occasionally sticks into the

May 24, 1899.

Dear Doctor,

This is the first letter that I have written and it is very slow work, I have not practiced as much as I should but by next winter I hope to be a perfect writer

As my hand is very tired and my ^{fingers} are stiff I shall have to close,

Yours truly
L. T.

FIG. 16.—Case V. Specimen of writing with disabled hand after practising for five weeks,—three months after gymnastic treatment was instituted.

paper when she tires. She has this day written a letter to me (Fig. 16), with her right hand, to show how she had progressed. Her physician has expressed himself as amazed at the improvement attained in her posture, and in the utility of her right upper and lower extremities. (Figs. 11, 13, 17, and 18.)

May 26, 1899.—Treatment was discontinued for the summer, to be resumed in October.

CASE VI.—*Lateral Sclerosis*.—March 9, 1899. Female, aged twenty-nine years, single. Health as a child was perfect. Never

had any illness requiring the services of a physician. About seven years ago she had an attack of so-called intercostal neuralgia. This was followed by a weakness in the knees and an increasing unsteadiness of gait. A neurologist was consulted, who treated her for a specific spinal lesion without improvement. One year later (1893) another neurologist was consulted, and patient was treated by suspension and internal medication, also, as she claims, without benefit. She has been under constant treatment since. Massage, electricity, and the actual cautery have been assiduously applied, and many drugs, including nitrate of silver, arsenic, phosphorus, and the iodides, have been administered. She walked fairly well for the first two years, but after that—*i.e.*, for the past five years—she had more and more difficulty in walking. For the past two years she has been unable to walk without support, and at the present time can hardly do that. She cannot stand alone for a moment. She is practically helpless. The gait, such as it is, is spastic, the heels touching the floor very lightly.

Physical Examination.—Patient is very nervous; is well nourished; heart and lungs normal. Greatly exaggerated tendon reflexes from quadriceps extensor femoris to the foot on each side. There is no clonus; no disturbances of sensation, tactile or otherwise. Galvanic reactions are normal. There is no apparent loss of power. No ataxia. Patient co-ordinates very slowly.

Advised experimental treatment for re-educating her muscles to enable her to acquire control and co-ordination.

March 21, 1899.—Experimental treatment commenced. This consisted of general instructions in leg and foot exercises, including practice in standing. These treatments to continue thrice weekly for two months.

April 4, 1899.—Patient had an accident to an eye on March 28, which made treatment prohibitive from that time to date.

April 20, 1899.—Patient is progressing to a remarkable extent. She stands very well; she raises herself upon her toes from ten to fifteen times; she raises herself upon one toe from three to five times. She can stand upon one foot, with the opposite thigh flexed to a right angle with the body, from ten to twenty seconds. She goes through exercises Nos. 13, 20, 23, and 26 of the small-bell exercises (ANNALS OF SURGERY, August, 1895) very well. Patient informs me that she carried a tray with dishes a distance of thirty to forty feet without faltering. She also states that

she walks better and with more assurance in her home than she does on the street. She can go up and down stairs quite well, and goes about the house without assistance, and is quite helpful.

Within the past week she has been shopping (the first time in two years); she stood for a fitting in a dress-maker's establishment; stood in a cable-car without much discomfort, and went to the theatre.

May 20, 1899.—The term of treatment contracted for expires to-day. Patient has made very great progress. She says that she is quite independent. She, to-day, walked up and down stairs in my presence, without holding the rail or touching the wall. In addition to the exercises cited in note of April 20, she can jump eight inches from the floor repeatedly; she can jump forward from twelve to eighteen inches; she can walk on her heels and can exercise with weights. She, to-day, used a twenty-six-pound bar, balanced overhead; swung a fifteen-pound bell thirty times overhead with each hand, and pushed two ten-pound bells eighty times. The present condition of the patient is such that I feel warranted in looking forward to a complete recovery from her previous helpless state if the treatment is persisted in. She was advised to continue exercising daily throughout the summer.

The results which I have obtained by careful muscular development and education, in comparatively short periods in each case,—after the long-continued application of massage and electricity,—establish beyond any doubt the inefficiency of the latter means—viz., massage and electricity—as therapeutic factors in the treatment of these conditions, more especially after these conditions have been of several months' or several years' standing.

These results also demonstrate the facts that, where the nerve communications have not been completely destroyed, the impaired muscles can be made to functionate by intelligent and persistent treatment by the physician who has studied their actions and functions.

SUCCESSFUL REMOVAL OF A FIBROSARCOMA
(DESMOID FIBROMA) OF THE ABDOMI-
NAL WALL, INVOLVING THE
ILIAC VESSELS.¹

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OF CHICAGO,

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TUMORS of the abdominal wall are comparatively rare, and of the varieties found fibroma comprises nearly 90 per cent. Fibroma of this locality presents some peculiar features, which make it a subject of much interest to the pathologist and to the surgeon. According to the collection of Guerrien, as given by Senn ("Pathology and Surgical Treatment of Tumors"), nearly 93 per cent. occur in women. It usually follows childbed, and trauma is the common determining cause. The tumor usually begins in the fascia in the lower segment of the abdominal wall, and particularly about the crest of the ilium and the sheath of the rectus muscle. It has a marked tendency to extend inward, and may readily be mistaken for an intra-abdominal growth.

This tumor presents certain characteristics which make it difficult of classification. The tumor itself presents the histological characteristics of a fibroma, but it manifests a marked tendency to infiltrate adjacent tissues, and to recur after enucleation, but complete excision usually effects a permanent cure. Some authors classify these tumors as fibrosarcomata, while others consider them as a peculiar variety of fibromata.

¹ Read in the Section of Surgery, American Medical Association, June, 1899.

Nélaton early recognized their peculiar features, as did Müller, who, to distinguish them from simple fibromata, designated them as desmoid fibromata. The term desmoid would, according to our standard dictionaries, indicate a tumor springing from a fascia or a ligament. Senn, in his work on tumors, again calls attention to the peculiar features of these fibromata, and advises the retention of the term desmoid as a special designation for those tumors which begin in the fascia of the abdominal wall, which present a histological structure resembling fibroma, and which seldom recur after total extirpation, but which manifest a tendency to infiltrate adjacent tissues, and to return after simple enucleation. Many will readily recognize in this description some of the characteristics of sarcomata, and, I believe, all will agree that the tumor occupies a peculiar indefinite position on the border-line between the benign and the malignant. It probably represents a transitional stage in the transformation of a fibroma into a sarcoma, and the degree of infiltration would seem to indicate the extent to which that transformation had progressed. While most desmoids occur in the abdominal wall, they may occur in other localities; Professor Le Count has informed me personally that he has examined two specimens of desmoid fibroma taken from the male breast and one from the neck.

The case upon which this report is based is as follows:

Miss —, twenty years of age, and a well-proportioned lady of nearly six feet in height, and weighing about 250 pounds, was brought to me by the family physician, Dr. J. A. Crowell, of Iron Mountain, Mich., for examination.

The following meagre history was all that could be elicited: Between two and three years previously she had noticed a drawing sensation in the right side. Upon stooping she experienced pain in the right inguinal region, which was also noticed after long walks, and especially during menstruation. Her principal, in fact only marked, pain was during menstruation, which was invariably referred to the right side of lower abdomen. She had never been pregnant, and did not remember having sustained traumatism of the parts.

In June, 1897, nine months previous, she first detected a swelling deep in the groin, and about two months later a physician examined it, at which time it was apparently the size of an orange. It had not been particularly painful upon manipulation at any time. During the last three months there had been a rapid increase in the size of the swelling, and the pain had also increased.

Upon inspection, a large protruding swelling could easily be observed with patient in either the erect or recumbent posture. By palpation we were able to determine a very firm, fixed swelling, apparently of the size of one's head, situated in the right inguinal region and projecting into the hypogastric region. The marked obesity of the patient made the size of the swelling appear much larger than it actually was. The upper border was well defined, while the lower border seemed continuous with Poupart's ligament. The surface was generally smooth and regular, but a few nodular irregularities were noted.

Vaginal examination was quite unsatisfactory, on account of the size of the patient and depth of the pelvis. A somewhat indefinite, irregular, and tender swelling was detected in the right pelvis, near the brim. No direct connection with the uterus could be determined at the time of the examination. Examination of the lower limbs failed to detect any disturbance of the circulation or nutrition of the corresponding one. No glandular enlargement detectable anywhere.

Dr. Crowell had made a careful examination of the patient, and had diagnosed the condition as one of probable sarcoma or fibroma. From the clinical history and examination we readily concurred in the diagnosis, and from the location and peculiar features of the case, we believed that it was one of those quite rare cases of fibroma of the abdominal wall, classed as desmoid. From its primary location the tumor had begun in Poupart's ligament, and gradually extended inward and upward, involving all of the ligament and a large section of the abdominal wall, and completely filling the iliac fossa, with a portion projecting into the pelvis. The extreme thickness of the natural abdominal wall of this patient precluded a definite outline of the growth.

In view of the very rapid growth of the tumor within the preceding three months, the transformation of a fibroma into a sarcoma was suspected. While the size and attachments of the

tumor impressed us with the great difficulties which would be encountered in its extirpation, and notwithstanding that there was a strong probability of our being unable to completely remove the tumor, we decided, in view of the perfect health of the patient and the absence of any œdema or other evidence of disturbed circulation in the limb below indicating involvement of the blood-vessel walls, that there was a possibility of its successful removal, and that the patient should be given the benefit of that possibility.

The seriousness of the situation, which had already been presented by the attending physician, was again stated to the patient and relatives, and the operation decided upon. As the hospital was full at the time, the patient returned to her home, and a week later we operated with the assistance of Drs. Crowell, Wescott, and Cameron, and with Drs. Carpenter, Lockett, and Menistrana present. Schleich's anæsthetic compound of ether, chloroform, and benzine was skilfully administered by Dr. Cameron. Preparation of operative field and hands was thoroughly made by soap and brush and alcohol only. No other chemic disinfection was made.

An incision ten inches long was made over the most prominent part of the tumor, parallel to Poupart's ligament, and just below lower abdominal fold.

Upon dividing the exceedingly thick layer of adipose tissue nodules of the tumor were observed involving and projecting through the aponeurosis of the external oblique muscle, from the indefinite crease of Poupart's ligament upward for about five inches. The projecting masses were smooth, dark in color, and very vascular. Having in mind that the principal element of success in the operative treatment of such tumors was the complete, even more than complete, removal, we made an incision vertically from the anterior superior spinous process, and carried it in a curved direction above and around the tumor and down to the pubic spine. The whole thickness of the abdominal wall was incised. The attachments of the tumor seemed very slight below the muscles, and extirpation progressed rapidly.

Our hopes for a rapid enucleation of the deeper portion were dispelled by encountering a large lobe of the tumor in the depth of the iliac fossa, which was of larger size than the superficial portion, and which was separated from it by a deep furrow corresponding to the location of the lower abdominal fold.

The inner end of the tumor was firmly connected with the pubic bone, at the attachment of Poupart's ligament, with which structure it was inseparably connected throughout its whole length.

To remove the deeper portion of the tumor it was found necessary to resect an oblong section more than five by six inches of the peritoneum, which was intimately attached to the inner lobe.

The great thickness of the abdominal wall made separation

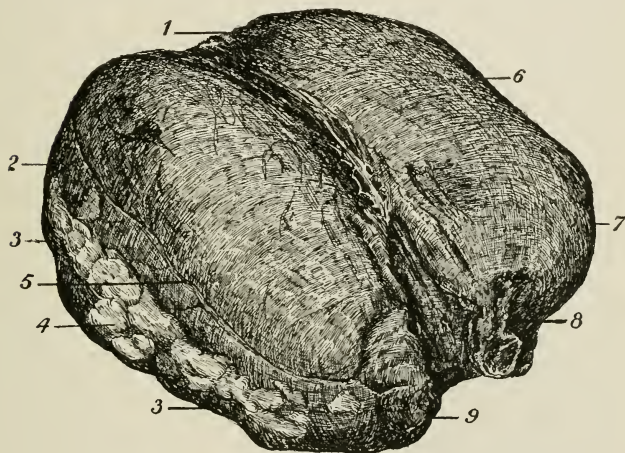


FIG. 1.—Desmoid fibroma of the abdominal wall. 1, muscular fibres of internal oblique muscle; 2, point of attachment to anterior superior iliac spine; 3, Poupart's ligament attenuated; 4, fat in groin; 5, cut edge of aponeurosis of external oblique muscle; 6, deep lobe of tumor, partially covered by peritoneum; 7, portion of tumor projecting into the pelvis; 8, round ligament; 9, attachment of Poupart's ligament to spine of pubes.

of the deeper portions exceedingly difficult, and as the tumor dipped into the pelvis the dangers of a blind dissection can readily be appreciated. It was impossible to view the deeper parts of the wound with the tumor *in situ*, and when the tumor was elevated the femoral pulsation would cease, which confirmed our fear that it surrounded the vessels, and that enucleation was impossible. As any attempt at its removal *en masse* was unsafe, and as I be-

lieve impossible, a horizontal section was made, and the greater part of the tumor with all of Poupart's ligament and part of the fascia lata were removed. (Fig. 1 shows outline of tumor and relation to Poupart's and round ligaments, and to the peritoneum.)

Upon investigation we found that the tumor had extended along the iliac fascia and that the lower part of the iliac fossa and the outer part of the right broad ligament were occupied by the remaining portion of the tumor. The iliac vessels were completely surrounded by the tumor for a distance of five inches. From the soft, friable, and vascular character of the tissues remaining we feared that the tumor was no longer a simple fibroma, but instead a more rapidly growing sarcoma. From an operative stand-point it was also evident that the difficulties of the operation had only begun. The complete removal of the tumor was considered by those present as practically impossible, and the danger of damaging the vessels was so imminent in a wound of such great depth that one would have been justified in abandoning the attempt. With the conviction, however, that the growth would return unless completely removed, we decided to continue the extirpation as long as the patient's condition would permit. We accordingly rapidly dissected away the iliac part of the tumor, including the iliac fascia, and began the tedious work of dissecting out the iliac artery and vein, whose walls were infiltrated throughout their whole extent by the tumor. The absence of any circulatory disturbance in the record of the examination must be accounted for by the fact that the lumen of the vessels had not been encroached upon.

The room in which we operated was lighted by low south-exposure windows, and it was necessary to turn the patient on her side, and to allow the sunlight to fall directly into the wound to light up its deepest parts. While rapid completion of the operation was desirable, it was absolutely impossible and palpably unsafe under these circumstances.

We succeeded in removing every particle of the tumor, and in doing so it was necessary to remove considerable of the external coat of the external iliac artery throughout nearly its whole length. Only a slight hæmorrhage was encountered, and that was due to the necessary division of the circumflex iliac vein and the small arterial branches to the psoas muscle, as we had

previously ligated the internal epigastric and internal circumflex iliac arteries.

The ovary of the right side was found to be large and to contain one cyst, the size of a small hen's egg. As the operation wound was already of startling size, we did not care to add any additional and avoidable elements of danger to the case. The condition of the ovary would certainly have justified its removal, but, under the circumstances, I believe its being left alone was the best surgery.

With the tumor removed and an immense excavation in the side extending down into the broad ligament, and presenting the iliac fossa and Scarpa's triangle as one space, the last difficulty was encountered. How to close the large defect in the abdominal wall now suggested itself. I decided to follow the same principles as I do in herniotomy; first, close the peritoneum; second, restore muscular continuity; third, secure tendinous or aponeurotic support; and, fourth, to close the skin over the deeper structures, but not to utilize it in any way as a supporting element in the closure of the defect, nor to include it in the deep sutures.

The peritoneum was closed from the side of the bladder to near the crest of the ilium. While the closure in the pelvis below the vessels was difficult, the great protection to the dangers of a possible infection made it seem imperative to close it absolutely. This procedure transferred the iliac and part of the pelvic fossa from intraperitoneal to extraperitoneal cavities. As a large resection of the muscles of the abdominal wall had been made, we split the fibres of the rectus abdominalis and the sartorius and sutured them across the defect, connecting them externally with the divided internal oblique.

To fortify this delicate muscular layer I split the remaining aponeurosis of the external oblique parallel to and about four inches above the line of resection, and slid it downward so that its lower edge occupied the position of the removed Poupart's ligament, and fixed it there by sutures. This gave us normal muscular support without aponeurosis of the external oblique above and artificial muscular support with normal aponeurotic support below. In addition to these elements of support we calculated that the large cavity would be filled with scar tissue which would directly support the abbreviated peritoneal wall and

would also lessen the pressure on the overlying support which we had constructed. The skin was sutured and gauze drain inserted, to be left for two days.

The wound healed promptly within ten days. The patient maintained the recumbent posture for four weeks, and wore an abdominal support for six months.

The result has been much better than we anticipated; in fact, it is absolutely perfect, both as to contour and as to support.

I examined the patient three months after the operation, and



FIG. 2.—Desmoid fibroma. Result of plastic operation.

could find no return of the tumor and absolutely no evidence of a ventral hernia, or any weakness of the abdominal wall. When the patient stands up now there is no deviation from the normal contour noticeable, and even the scar is practically out of sight in the abdominal fold. Lateral exposure also fails to show any bulging of the abdominal wall. (Fig. 2 shows perfect Poupart's fold and appearance of scar on raising of pendent part of abdominal wall.) The cyst of the ovary has practically disappeared.

The absence of the return of the tumor within fifteen months warrants the conclusion that the radical operative treatment was

perfectly successful, and the absence of a ventral hernia evidences the fact that even extensive defects of the abdominal wall can be successfully repaired by plastic utilization of the remaining normal structures.

Microscopic examination of the various portions of the tumor have kindly been made by Professor Le Count, who confirmed the clinical diagnosis of desmoid fibroma, and submitted the following report of the histologic examination: "From the section of the entire tumor, which was cut in a fresh condition, a number of small pieces were selected. These exhibited small variations in color and consistency, but histologically were all found to contain essentially the same features,—viz., well fibrillated cells with scanty amount of intercellular substance. Such blood-vessels as were encountered resembled sinuses with atypical hyaline walls. The above-mentioned variations were judged to be due to difference in the amount of blood and to œdema."

SARCOMA OF THE STOMACH.

By F. V. CANTWELL, M.D.,

OF EL PASO, TEXAS,

LATE SURGEON TO ST. FRANCIS HOSPITAL OF TRENTON, N. J.

MRS. X., aged fifty-two, patient of Dr. Robbins, Hamilton Square, N. J., was brought to the St. Francis Hospital, Trenton, N. J., in November, 1898. She had no symptoms, except for the past few months the ever-increasing weight in the abdomen with slight pain recently. She came to the hospital simply because her abdomen was getting larger, and she thought she had a tumor.

Upon inspection, while patient was lying on her back, the abdominal walls were pushed upward, and assumed a blunt-pointed pyramidal shape, with the apex at, or a little above, the umbilicus. A large, soft tumor could be felt; no fluctuation. The most natural thing to suppose was that the tumor was connected in some way with the genital organs; but this could not be made out clearly, owing to the size of the tumor. As there were no positive symptoms, there was no finger-board pointing to accurate diagnosis.

The patient was kept in the hospital long enough to prepare her for a laparotomy, and as she was in excellent physical condition, it required but few days.

On November 20 an incision was made, and an immense mass covered by omentum and mesentery presented itself. The uterus, tubes, and ovaries were normal. The kidneys were examined and found normal. An opening was made through its envelope down to the tumor proper, which was so soft as to verge on the gelatinous, and from its whole surface there oozed bloody serum. It was impossible even yet to find its attachment, the tumor had so disarranged the normal anatomical relations. It was not until I had carefully enucleated and lifted it partly from

its bed that I found that it arose from the posterior wall of the stomach down to its greater curvature. The weight had dragged the stomach down to a point several inches lower than its ordinary position.

The tumor with part of the stomach was cut away with scissors, the stomach wall being caught in forceps, as it was cut so as to facilitate suturing.

The stomach wound was closed with two tiers of sutures. First, a continued suture penetrating the wall of the stomach through and through, so that I succeeded fairly well in bringing the *cut* surfaces together. Of course, before tightening this suture, the stomach, or what was left of it, was well washed out. Then a row of Halsted mattress sutures was applied as accurately as was possible in such a deep-seated wound. For when the tumor was removed the stomach was forcibly drawn up, and were not the forceps on the cut edges I could not have had very easy access to it.

In my efforts to deliver the tumor about four inches of small intestine was torn from its mesentery; this I attached as well as I could, and after washing the abdominal cavity I inserted a piece of gauze down to the stomach wound, and closed the incision in the belly walls, leaving a small opening for drainage.

The after-treatment was very simple. It consisted in using the rectum alone for the assimilation of food and allowing the stomach absolute rest for eight days. She then was given some hot water, then tea and milk, and then beef-tea, and was gradually brought back to ordinary diet. On Christmas, about five weeks after the operation, she ate a good dinner of turkey, and relished it.

The day following the operation she vomited a small quantity of blood, after that nothing.

On the tenth day a double parotitis developed, but subsided without suppuration. The drainage was abandoned on the eleventh day.

About the fourth week after the operation an abscess formed below the drainage-opening under the line of incision. This was cleaned out, and no other complications occurred.

She left the hospital eight weeks after the operation to all appearances a well woman, and has since been able to attend to her house.

The case was remarkable in many ways. First, the presence of this mass, involving a part of the mucous lining of the stomach with no stomach symptoms; in fact, no symptoms of any kind save those of weight and pressure. Second, that such a large wound in the stomach wall (a breach) was made water-tight by so simple a method of suturing. There was no leakage, and the vomiting on the second day was rather a favorable indication. Third, that her convalescence as far as



Sarcoma of stomach after removal.

stomach wound went was without incident. Fourth, the absence of any special blood-supply, as but one artery was tied during my manipulations, and that, I think, was one of the gastro-epiploic.

The size of the tumor (it weighed about twelve pounds) and the amount of stomach involvement can best be seen in the photograph. At the upper middle are seen two wooden tooth-picks arranged in T-shape. These hold apart the inner walls of the portion of stomach removed. As these tooth-

picks are three and a half inches in length, it will be seen that about five inches square of the stomach wall were taken away. In front, holding up the tumor, is a lead-pencil seven inches long. The portion of the tumor to the left, lying on the table, was broken off by its own weight, thus showing the almost gelatinous consistency of the mass. This photograph was taken within half an hour after the removal.

The tumor is a spindle-cell sarcoma of the stomach, a growth of great rarity. I believe that when Baldy, a few years ago, reported his case of sarcoma of the stomach, he was not able to find more than a half dozen cases in literature.

The tumor, I am now convinced, lay entirely within the lesser cavity of the peritoneum, arising, as it did, from the lower posterior aspect of the stomach. Its envelopes consisted of the outer two layers of the great omentum. The healing of the wound was no doubt facilitated by the adhesion of the omentum to the parietal peritoneum, thus cutting off almost immediately the general cavity of the abdomen. The drainage was through the great omentum into the lesser cavity, which in process of healing has probably become obliterated.

The transverse colon was, of course, pushed down by the growth of the tumor as it made its way in the direction of least resistance.

Through the kindness of Dr. F. X. Liedmeyer I am enabled to give her present condition (July 25, 1899). Up to four weeks ago she felt well and was able to work around her house. Then she noticed obstinate constipation with a great deal of distention. On inspection, the abdomen looks normal. On palpation, a hard tumor, about the size of an infant's head, can be felt on the left side, in the region of the stomach. There is, without doubt, a return of the tumor after eight months of comfort.

REPORT OF A CASE OF CONGENITAL INGUINAL
TELE-LYMPHANGIOMA OF LARGE SIZE,
WITH REMARKS ON CONGENI-
TAL TUMORS OF CHILD-
HOOD.

By ESTELLA M. RILEY, M.D.,

OF CINCINNATI.

THE patient, at present twelve years of age, when born presented in the right inguinal region a tumor as large as a foetal head, white in appearance, of spongy consistency, and ovoid in shape, the surface very pale, in some parts large blue veins clearly discernible. The first event of significance in the child's life was a spasm, which occurred when she was four weeks old, and from this time on, until she was about a year old, the spasms occurred daily. They were always attended by loud screams. After she had passed the first year, they were of less frequent occurrence.

The tumor commenced to grow when she was a month old, increasing rapidly in size, and, according to the statement of the mother, when the child was three months old the tumor for a time was of a dark, livid color. Hæmorrhage first occurred when she was two years old, due, of course, to pressure of the growth upon the superficial veins; these openings, caused by the outlet of blood, always healed without difficulty after the hæmorrhage ceased. The child has always felt sick, has had severe headaches, and frequently elevated temperature. During the past few years she has had several very severe attacks, during which her life has been despaired of. When an acute spell comes on, the tumor seems to enlarge, her temperature is raised, and she imagines herself surrounded by snakes and lizards; in fact, acts exactly like a person with delirium tremens. At an earlier age these appearances frightened her into convulsions, but she is now old enough to realize that they are of no significance. She is

anæmic in appearance, having the peculiar, transparent paleness that we sometimes see associated with renal and sarcomatous disease. The tumor commenced discharging about one year ago! occasionally it dries, and she immediately feels sick at the stomach, but is always relieved when the ulcers open. The discharge is serous in character, sometimes mixed with blood, and becomes very stiff upon drying.

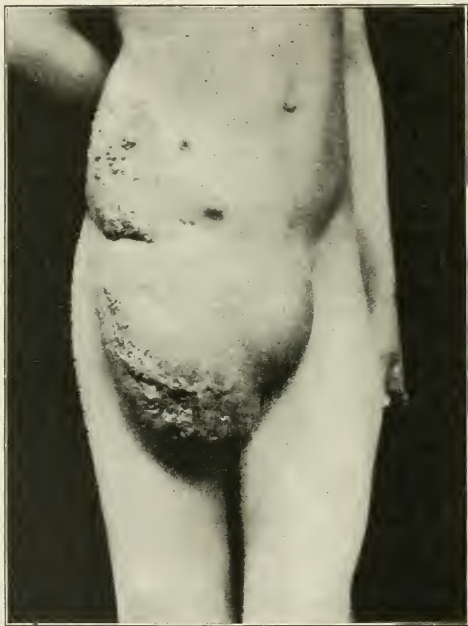
The tumor enlargement begins at the lower border of the ribs, on the right side, and extends downward fourteen inches in length. On the upper part is a superficial venous telangiectasis, eight inches long and four inches wide. This has scattered over it black, raised masses, which, when they fall off, crumble between the fingers exactly like sand or cinders. The lower edge is ulcerated. The mother attributes the nævus to a maternal impression, she having extinguished a fire, while *enceinte*. The dependent portion of the tumor is reddish in color, and is covered with dark, rounded crusts from whose surface oozes the bloody discharge. The growth is nine inches broad and is in two parts, the inner being formed by a hernial sac involving the labium majus. The tumor proper is of rather firm consistence, and is movable to some slight extent. (See figure.)

In regard to the family history, one of the remaining children has convulsions, while two are somnambulists. The father drinks to excess, which may account for the family being of the neurotic type.

I have found only two cases reported at all similar in reference to location and dimensions. The first case was reported in 1883 (*British Medical Journal*, Vol. ii), by Willett. The child was three years old; the tumor was only the size of an egg, and occupied the right inguinal region, and projected into the labium. The upper part was solid, but the lower portion contained fluid. In this case there were occasional attacks of vomiting and elevation of temperature. The doctor did not consider it a cystic hygroma, because of the large amount of solid tissue in the upper part. However, it was opened and the cavity drained; but it was considered too dangerous a procedure to remove the upper part.

Another case was reported (*Transactions of the Pathological*

Society of London, Vol. xxxix) in a child, thirteen years of age, who was admitted to the London Hospital with a large growth of the abdominal parietes. The swelling was noticed when she was four months old (but it is safe to say that it was congenital), and increased gradually in size. It was painless and projected from the left side of the abdomen, attaining a



Congenital tele-lymphangioma of groin.

size of twelve inches by nine. The tumor was white, movable on the deeper structures, yet was sufficiently attached to lead to the suspicion that it might send a prolongation between the abdominal parietes. Its uniform consistency and appearance led to the supposition that it was a lipoma. On operating, it was found that the tumor was covered by a sheath

of the external oblique, and its deeper portion was attached to the fascia transversalis. It contained fibrous tissue, which had increased in quantity, and had undergone fatty degeneration. There was no connection between the tumor and inguinal canal, round ligament, nor peritoneum, as was at first feared. The chief points of interest are the situation of tumor and its congenital origin. The interest as regards operation turned on its relation to the abdominal fasciæ and to the above-named structures.

These cases are the only ones which we have been able to find that are similar in regard to shape and situation to the case that we have reported, and these differed in one or two respects. They were, however, from their clinical features conceded to be lipomas.

Very similar to the present case was one of congenital tumor (*Medical Times and Gazette*, Vol. i) situated in the lumbar region, eleven inches around its base, extending from twelfth rib to the crista ilii. It was elastic and not lobulated, and was very vascular. It was removed by operation. The tumor was fibrous (encapsulated) and sprang from the lumbar aponeurosis. In this case it was first thought that the tumor might be fatty or perhaps an hygroma. Its rate of growth was not rapid enough to entertain the thought of sarcoma, nor did the appearance of the skin suggest it.

Upon microscopic examination it was proven to be a fibro-cellular growth, and from this it is classed, according to Virchow, as fibroma fasciæ, or as fibroma aponeuroticum.

It will be interesting to note the relative occurrence of tumors in childhood. Marc ("Ein Fall von Leiomyoma subcutaneum congenitum," *Virchows Archiv*, Band cxxv, 543) found that in 5000 cases admitted to the Surgical Clinic, there were only 121 cases of tumor growth. Very few of these were congenital. Of all the cases, by far the most (forty-six) were angiomas. Next in number were sarcomas, of which type there were eleven. There were ten cystomas. The remaining number were divided among the rarer forms of tumor growth in children, only three lipomas and one

fibroma being noticed. While more female children were found to be affected with growths than males, yet the latter are more frequently subject to malignant disease, of which sarcoma is almost the only form in childhood. Sometimes these growths are the result of a nævoid condition of muscular tissue; or, they may develop from some foetal residue.

As to the exact histological structure of the tumor in the case now reported, in the absence of the exact demonstration obtainable after its removal by operation or at autopsy, positive statements are impracticable, but in view of its history, its location, its course of gradual growth, and its consistency, it is probable that it is made up of dilated and thickened blood- and lymph-vessels, with much fibrous and fatty tissue binding the vessels together, and forming now the greater bulk of the mass.

I think from her appearance that dissolution in the near future is not an improbable event. Operation would only hasten this issue, as the association of the tumor with the abdominal parietes is too intimate and broad to make its removal possible.

ACTINOMYCOSIS IN MAN, WITH SPECIAL
REFERENCE TO THE CASES WHICH
HAVE BEEN OBSERVED IN
AMERICA.

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(Continued from page 451.)

Thoracic Forms.—These may be divided into three different classes, œsophageal, mediastinal, and pulmonary.

Infection may take place in several different ways,—inhalation, direct infection of the œsophagus, extension, metastases.

In the first way the organism may be breathed in from without the body as in the cases reported by Boström, Illich, and others. In their cases the patients began to cough shortly after they had beaten out the grain of their harvest. It may also be inhaled from lesions situated in the mouth or pharynx. Israel claims that infection of the lungs only occurs when some foreign body is inspired along with the organism, thus in one of his cases he found a piece of a tooth.

In speaking of the second form, that of direct infection of the œsophagus, one must call to mind the case of Soltmann, where a small boy swallowed a sheath of barley which wounded the lining of the œsophagus. Following this there was extensive involvement of the tissues between the shoulder-blade and the spinal column, and also lesions of the lungs. Infection of the œsophagus and of the other thoracic tissues may take place through direct infection. The offending

lesion may be above, in the neck, or below, in some of the abdominal organs. In the latter case the path of infection is generally along the portal vein or by way of the retroperitoneal tissues. Direct infection of the lungs may take place from the subcutaneous tissue, as in the case of Hudson and Flexner, where the primary lesion was in the back.

Metastasis may take place from lesions in any part of the body. The organism being carried to the lungs in the blood-stream.

Œsophagus.—The best account of actinomycosis of the œsophagus is that given by Poncet and Bérard. Their studies cover the seven reported cases of primary lesions. In three of these the original wound of infection had disappeared. In the other four there was some trace of it. In one an old cicatrix, in another a fistulous tract, etc. As might be expected, the symptoms are very vague. In some of the cases there was difficulty and pain on swallowing, and in Soltmann's case there was severe pain behind the sternum. In Poncet's case there was evidently extension from the thyroid gland and adjacent structures. A swelling formed in the throat which opened spontaneously into the œsophagus. On swallowing the liquid food passed into the trachea and caused severe coughing. The case was operated on and subsequently the sulphur granules were seen in the pus. The lung became infected and the organism was found in the sputum. There are numerous cases where there has been direct extension, and they merit careful study as to the point of entrance, as the primary infection of the œsophagus may be more common than is commonly supposed.

Pulmonary Form.—In this form there are three varieties known, and we might reasonably expect to find a fourth. These are:

- (1) Bronchial form, based on a single case.
- (2) Broncho-pneumonic form, the class of cases following air infection and the inspiration form.
- (3) Pleuro-pneumonic form where the lesion has extended from adjacent structures.

(4) Problematic. Munch (*Correspondenzblatt für schweitzer Aerzte*, quoted by Hodenpyl) has described a form in cattle analogous to miliary tuberculosis. There were numerous small miliary deposits in the lungs. Cases of this sort have never been described in man, although West (*Transactions of the London Pathological Society*, 1897) makes the statement that he has found three such cases in literature. In two of them there were lesions elsewhere (in the liver in one and in the œsophagus in the other). He does not give the reference to these cases, so it could not be confirmed.

The evidence that there is a superficial bronchial form rests on the report of Canali, of a case of bronchitis lasting for seven years without involvement of the lung-tissue. The symptoms were always aggravated in hot weather, and the patient was always better in winter. She suffered little or no pain. The case was finally lost sight of.

The second form is found in two classes of cases as given above. The pathology of these cases is very much that one would expect. They have been carefully studied by Baumgarten and others. The lesion starts in the bronchi and spreads rapidly to the adjacent alveoli. There is at first an abundant catarrhal exudate with desquamation of the epithelium. This allows the escape of the parasite into the sub-mucous tissue, and from there it rapidly involves the lung structure. There is the formation of numerous nodules of the characteristic type. These are composed of the usual structure, a clump of the organisms surrounded by a more or less degenerated zone of cells, composed of small round cells of the lymphoid type, together with epithelioid cells and an occasional giant-cell. This is surrounded by an irregular wall of connective tissue, following which are numerous other groups of the same kind shading off into the lung tissue. The alveoli for a considerable distance are filled with an exudate of serum of an inflammatory type and some small round cells.

The pleuro-pneumonic form is not always to be clearly distinguished from the above mentioned, as after extensive

progression of the disease the lesions are much alike, and when the disease has extended to the adjacent organs there is little indeed to warrant a separate division of the cases. The distinction is, therefore, often merely a clinical one, to be told from the history of the case. Sometimes there is a very distinct difference. In these cases most of the thoracic structures are fixed together in a mass. The pleura is thickened and contains the typical actinomycotic structure. The lungs are in a more or less complete state of solidification, grayish in color, and they may be diminished in size. The naked-eye appearance is that of numerous bands of connective tissue running at different angles, forming a more or less complete honeycomb structure. The interstices are filled with yellowish pus.

Hodenpyl (*Medical Record*, December 13, 1890) has studied thirty-seven collected cases of actinomycosis of the lung, in which there were fourteen autopsies. He found that there were more males affected than females, and that the ages ranged from nine to sixty-three. The lesions were limited to one lung in a proportion of one to three. The lesion is also, as pointed out by Israel, almost always in the lower lobes. This is the opposite of what is true in tuberculosis and like deglutition pneumonia.

West (*loc. cit.*) has analyzed thirty cases where there were primary lesions in the lung. He records a case in a child of six, the pleura being the principal site of the disease. The pleural cavity was filled with a sarcoma-like mass. The result of his analysis showed that there were seventeen males and ten females affected. Sex not stated in the other cases. The left side was the site of the lesion in seventeen, the right in eight, and both in two. The lower lobe was affected in thirteen cases and the upper in three. One case was cured, one improved, and the remainder died.

The neighboring organs may be the seat of extensions. The mediastinum with its structures may be involved. The pericardium and the heart are affected in some cases. Illich gives eight cases in fifty autopsies. The pericardium is found

thickened and roughened, and in some cases there are small nodules of actinomycotic structure. The pericardium may contain pus. In the case of Paltauf (*Wiener klinische Wochenschrift*, 25, 1890) there were some 300 cubic centimetres of thick, grayish, fetid pus containing numerous yellowish granules. The epicardium may be affected and also the myocardium. In the case mentioned above there was a nodule three centimetres long by one and a half broad in the wall of the right ventricle, and smaller ones in addition. Some of them extended into the endocardium.

Raingeard has had a case where the peribronchial glands were involved.

Extension may also take place into the liver, spleen, and peritoneum.

The symptomatology of the disease, as it occurs in the lungs, is rather vague, and uncertain as far as relates to differential diagnosis. In eighteen of the thirty-four cases collected by Hodenpyl the diagnosis was made during life. In nine the organism was found in the sputum, and in the other nine it was found in abscesses connected with the lung.

It is a chronic affection, with an average duration of ten months. Death has supervened as early as the fourth month, and it may not occur until after several years. There are six cases of reported cures.

As to the general condition, it might be characterized as an affection attended with fever of a more or less variable type. In the main the fever resembles that of tuberculosis, and it has been likened to typhoid. The temperature-range is apt to be lower than in tuberculosis, but it has the morning and evening exacerbations. The fever is usually one of the early symptoms, but it may come on late, and in some cases it has been absent entirely. It seems to depend on the amount of pus formed, and also on the presence of secondary infections, which are so common in the pulmonary form of actinomycosis. There is always cough with an expectoration, increasing as the disease progresses. The expectoration is usually fetid and may at times be bloody. It may con-

tain the yellowish granules, but at times they are apparently absent. Their absence may be due to the lack of zeal on the part of the observer. In twenty-one cases mentioned by Illich the organism was found in eighteen. It is impossible to say how early the actinomyces can be found in the sputum. Hæmoptysis is very exceptional, having occurred but once in the reported cases, and a second case is presented in this paper for the first time (Blake's). In some of the cases the bloody expectoration may approach a regular hæmorrhage. Sweating has been observed in some cases. One of the most constant symptoms is pain. It has been noted in all cases except Canali's, where the lesion was supposed to be limited to the superficial portion of the bronchi. As a rule, the pain is referred to the lung on the same side as the lesion.

The physical signs vary with the extent of the disease. Signs of bronchitis are constantly present. There may also be signs of consolidation and of cavity formation or pleural effusion.

Pleural effusion is common where the lesion has reached the pleura. It is nearly always of a serous character at first, becoming purulent after it has been aspirated, no matter how careful may have been the operator in his aseptic technique. In rare cases it may remain serous throughout the disease. Netter has pointed out that there is a board-like œdema of the chest wall where there is actinomycosis of the pleura. This observation has not been borne out in most of the observations.

The anæmia and the cachexia so common in actinomycosis are present in the lung cases.

Attempts at close analysis, when one has but a few cases to study, are apt to be misleading in the extreme, so I shall use the following histories to illustrate the clinical features of the disease rather than to deduce any new facts. The cases cover a large field, and include two cases of recovery, one after the use of oil of eucalyptus. Most of the cases show the disposition to the extension of the disease to adjacent structures, and we find the resulting tumor-like masses or inflam-

matory processes manifesting themselves in the epigastrium, and in various localities in the chest wall. Two of the cases show the fetid expectoration, and in one it was only after repeated examinations that the organism was discovered. The clinical history of pulmonary tuberculosis is found in two of the cases, and the differentiation was made in one at a very late date. This was due to the fact that the sputum was not examined, the diagnosis being assumed on the physical signs and the history. Hæmorrhage from the lungs was noted in one of the cases, and in another the sputum was sometimes bloody. The lesion was in the mediastinum in one case.

CASE XXX.—Eugene Hodenpyl. Actinomycosis of the lungs (*Medical Record*, 1890, Vol. xxxviii, 653). Patient was a female, Swede, aged eighteen, who had been ailing for six months. For three weeks she had pain in the right chest, dyspnœa, fetid expectoration, fever, and night sweats. Had become pale and emaciated. Over the right chest dulness above and flatness below. Above bronchial breathing, voice a whisper, vocal fremitus less marked than on the left side. Over the left side exaggerated breathing and distinct voice. On the right side the dulness grew more intense towards the apex of the lung. Over this side there was constant pain. An abscess formed on the right side, just below the costal margin, and about a pint of pus was evacuated. Patient died of exhaustion five months after the commencement of the disease.

Autopsy.—Left lung large and œdematous, and there is some hepatization over the upper part of both lobes. Right lung completely adherent to the chest wall. Bronchi contain pus. Lung completely consolidated with thickening of the connective tissue, and a very general bronchial pneumonia. There is an abscess shut in behind the right lower lobe and communicating with the abscess in the back. There is a suppurating sinus behind the lung, between the two surfaces of the pleura, running up along the vertebræ. The ribs and the vertebræ were eroded behind this. The lung emitted a peculiar fetid odor. Microscopically the usual characteristic lesions were found. There were no clubbed ends. Residence, New York.

CASE XXXI.—(*Ibid.*) A school-girl, aged thirteen, had

an attack of broncho-pneumonia three months previous, from which she never entirely recovered, the cough persisting. Six weeks previous noticed a lump over the right shoulder-blade. This increased in size, and on incision a considerable quantity of pus and necrotic tissue was evacuated. Lung symptoms continued to increase until death, four months after the appearance of the disease. At the autopsy, the right lung was found to be entirely adherent to the chest wall, except for a small area. The ribs were eroded. Left lung slightly affected. Microscopical and macroscopical appearance much the same as preceding case. Residence, New York.

CASE XXXII.—J. M. Byron. A case of actinomycosis in man (*New York Medical Journal*, 1889, 1, 716). A man, twenty-eight years old, had chills followed by fever a month previous; these continued. Limited dulness of about four inches between the fifth and seventh ribs, between the anterior and posterior axillary lines. There was no deformity. There was a diminution of the breath-sounds, a few râles, and a pleural friction rub. Two weeks later there was bulging of the intercostal spaces and oedema. Puncture obtained pus, containing actinomycetes. Rib was resected and cavity drained. Patient left for Europe in a dying condition. Residence, New York.

The following two cases are remarkable in that recovery took place.

CASE XXXIII.—Glentworth R. Butler. "Pulmonary Actinomycosis; Recovery under the Use of Oil of Eucalyptus" (*New York Medical News*, 1898, Vol. lxxii, p. 513). Male, Swede, thirty-seven years old. Rigger by occupation. In October, 1888, patient received a head injury, and was admitted to the Seney Hospital in Brooklyn. A week later, when almost well, he had a rise of temperature to 101° F., respiration increased to 30, and this was followed in a couple of days by pain in the right side of the chest and a slight cough. Some weeks before he had a cough with dark-colored expectoration. Physical examination of the chest showed some dulness, subcrepital râles, weak respiration, and unaltered breath-sounds over the right base posteriorly. A few days later had very severe paroxysms of coughing, with the expectoration of dark sputum, which was

very offensive. Examination of this showed nothing of interest. Was given oil of eucalyptus in five-minim doses, every four hours, in capsules, and spray inhalation of the same oil was given three times daily. The dose was subsequently increased to ten minims. The purpose of the oil was to reduce the intolerable odor of the breath and sputum. About a month after the beginning of the disease the streptothrix actinomycotica was demonstrated in the sputum by Dr. Hodenpyl. At this time there was dulness at the left apex, extending down to the level of the nipple, with tubular breathing above the clavicle, and a weak respiratory murmur, with prolonged and low-pitched expiration over the infraclavicular region. Over the dull area there were numerous moist, large and small râles on both inspiration and expiration. There was dulness over the right base posteriorly; here the respiratory murmur was weak and accompanied by moist râles.

The patient gained steadily, and in a month from the time the diagnosis was made was free from cough and pain. Pulse, temperature, and respiration were also normal. There still remained a slight dulness over the left apex, and also at the right base. The oil of eucalyptus was stopped, and the patient discharged as cured.

CASE XXXIV.—E. A. Codman. (*Boston Medical and Surgical Journal*, August 11, 1898.) A man, aged forty-eight, who worked in a straw-hat factory. Three years previous to his having entered the hospital he had an attack of grippe with a bad cough. The cough lasted until a month before his entrance, and it was very marked and severe. His sputum was sometimes bloody, but generally frothy and yellow. One year previous a swelling, about the size of a dollar, appeared on the chest wall. This broke and a sinus formed. Nine months later another sinus formed in the same manner, and subsequently another one made its appearance. The chest examination was negative, except for a cardio-respiratory murmur in the region of the apex, and harsh breathing with a few râles in the left front in the region of the sinuses. Yellow granules were found in the sinuses. These healed under the iodide treatment. The patient took as high as 110 grains daily; one of the sinuses opened and healed several times. At the present time, from time to time a small mass, the size of a cranberry, appears, and this the patient opens himself.

The place is constantly growing smaller. The patient is in very good condition.

The most interesting feature of the following case is the occurrence of the pulmonary hæmorrhages. This is, as far as I know, the second case of the kind on record.

CASE XXXV.—J. D. Blake, Baltimore. Published for the first time. The patient was a Polish Hebrew, aged nineteen. She was engaged in house work. Was taken sick on August 11, 1897, with what was diagnosed malaria by her attending physician. Under antimalarious remedies she improved and went about as usual. On September 19 she had an attack of pleurisy, involving both sides. This was accompanied by high fever. She improved, but had a continuance of the pain in the chest and the cough. The doctor's last visit was made during the last days of October. She was told to consult him at his office from time to time. This she did not do, but called in another physician during the first week in November. This doctor told her that she had typhoid fever, and treated her accordingly for several weeks, when he told her she had tuberculosis of the lungs. She had developed a severe cough with muco-purulent expectoration, high fever, night-sweats, with loss of strength and weight. This diagnosis was concurred in by a consulting physician, but the sputum was never examined. This physician finally told her that he could do nothing more, and Dr. Blake was called in. This was in March, 1898. He found that she was greatly emaciated, and so prostrated that she could not stand alone. Her temperature was 103° F., and the pulse 120. The skin was hot and dry, lips dry, with great thirst, with frequent vomiting on attempting to quench it, with either milk or water. She had from six to ten watery stools in every twenty-four hours. She had frequent chills, after which she would perspire very freely.

On a careful physical examination it was found that the lungs were more free from disease than there was reason to believe from her general condition. At the lower border of the left scapula there was a tender spot, which gave slight evidence of fluctuation. On opening this there was an escape of a considerable amount of greenish-yellow pus, containing numerous yellow granules. These proved to be actinomycetes.

This abscess-cavity did not connect with the pleura nor with any other abscess-cavity. It was kept clean by irrigating with mild bichloride solution. From time to time other abscesses of the same nature made their appearance in different parts of the back, but always on the left side. The free incision of the abscesses, allowing drainage, brought the temperature down, and there was a marked general improvement for several days, when she had a severe pulmonary hæmorrhage. She rallied from the effects of this after several days, and although the breathing was rapid the respiration was clear. Several times, during the latter part of her sickness, she showed signs of pulmonary oedema. Three weeks after the first hæmorrhage she had another one of some severity, and after that several smaller ones.

Frequent examination was made of the pus, and the streptothrix *actinomyctica* could always be demonstrated. It was also demonstrated in the sputum.

During the last weeks of her illness, which terminated during July, 1898, the diarrhoea was not so marked, and there was less nausea and vomiting. Her mind remained clear at all times.

Through the courtesy of Dr. Blake, to whom I am indebted for the report of the case, I saw the patient and secured some of the pus from the abscesses.

When I saw her, about two weeks before her death, she was reduced to a mere skeleton. The left side of the back was the seat of numerous sinuses, whose puffed and reddened openings, together with the livid intervening skin, gave a perfect picture of actinomycosis. The right thigh was the seat of a large swelling, occupying the place where psoas abscesses generally make their appearance.

The pus was examined, and was found to contain the streptothrix in great abundance, and very typical in appearance. The clubbed ends could be demonstrated in some of the specimens. Stained by Gram's method, the threads were seen to be in some cases of great length. Some of them were swollen in places, and in some the ends were very markedly enlarged, though not the regular clubbed ends. Some of the threads stained interruptedly, and the stained portions were about as wide as the width of the thread, with unstained portions of about the same width. In some the stained portions were scattered at various lengths. The

unstained intervals being from ten to twenty times the width of the thread.

Inoculation experiments made on guinea-pigs failed, as did the culture experiments. The cultures were made on the ordinary culture media. The organism was also planted on sprouting grains of oats, but these were also negative.

CASE XXXVI.—Melvin S. Rosenthal. Published for the first time. Hebrew, aged seventeen, single; admitted to the Hebrew Hospital January 21, 1898. Died March 20, 1898. Family history good.

Previous History.—Had but few of the diseases of infancy. At four years of age had pneumonia. Otherwise he has been healthy, but always remarkably thin and pale. He is a clerk by occupation. Three and a half years ago he was vaccinated on the left arm. This was followed by a severe inflammation attended with suppuration. He had a running wound on the arm for a year following the vaccination. About six months after this vaccination he noticed a pain on the right side of the chest, especially marked on inspiration. This pain disappeared after several months' treatment. Treatment not known. Three or four months later he was again attacked with severe pain in the same region. He attributed the trouble at this time to a severe strain following the violent exertion of lifting a large box.

History of the Present Disease.—For about two months he has been troubled with violent pains in the right side. Had slight cough and expectoration. About five weeks ago he noticed a swelling on the right side, beginning at the angle of the sixth rib and extending posteriorly for about two and a half inches. This swelling was extremely painful and tender. Appetite poor. He has occasional night-sweats. Has marked muscular weakness.

Present Condition.—On entrance to the hospital he was five feet seven inches tall. Weight 112 pounds. Marked pallor and emaciation. Mucous membranes pale and anæmic. Teeth carious. (These were never examined bacteriologically.)

Contour of the chest good. Intercostal space depressed. Supra- and infraclavicular spaces prominent. Expansion, 33.5 by 32.5 inches. On the right side, beginning at the angle of the sixth rib, extending to the eighth below and two and a half inches posteriorly, a well-marked tumor, about the size of a

goose-egg, adherent to the ribs. This growth is very tender, and there is sensitiveness over the entire back on that side. There is slight dulness at the base of the right lung, roughened breathing, and a slight friction rub, in all other particulars the signs are normal. Left side of the chest is normal. At this time has no cough, but has occasional sweats and complains of pain over the growth on inspiration. Anorexia marked; temperature, 102° F.; pulse, 120, very feeble; respiration, 35. Liver and spleen normal; urine negative; sputum negative. Blood count,—reds, 4,250,000; whites, 12,000; hæmoglobin, 80 on von Fleischl's scale.

January 27: Incision made over the growth and a large quantity of thick yellowish pus mixed with blood was evacuated. The abscess-cavity was thoroughly curetted and carbolic acid applied. Iodoform dressing. Examination showed degenerated tissue with the presence of the ray fungus. Placed on potassium iodide.

Following the operation there was no change of the patient's condition. The wound was washed with a solution of nitrate of silver daily without producing any change in the character or quantity of the pus.

In addition to the iodide a tonic and stimulant treatment was pursued.

Pain in the region of the growth was not so severe after the operation. The patient's condition remained about the same until March 10, when a swelling was noted adjoining the seat of the operation. This increased rapidly, extending from the vertebræ to the midaxillary line, between the sixth and ninth ribs. Over this area there was great tenderness.

March 20: An incision was made over this growth, when it was found that the entire back on the right side was infiltrated, and several sinuses leading into the pleural cavity were found. A large portion of the affected tissue was removed, but, owing to the extensive involvement, much of the diseased tissue was left. Several sinuses led to the spinous processes, which were also involved. Patient died about five hours after the operation from shock.

I am indebted to Dr. Rosenthal for the above history.

CASE XXXVII.—C. A. Hoover, Cleveland, Ohio. I am indebted to Dr. Hoover for the following notes: Patient was a

man of sixty-five, a carpenter and builder by trade. Three years previous had treated a horse which had a swelling under his jaw. Three months after he had sold the sick horse he had a swelling under the right clavicle, about three inches in diameter. This became reddened and broke down, discharging a small amount of thin pus. This was extirpated by a surgeon who thought that it was a sarcoma.

There was a return of the swelling a few months later. When seen by Dr. Hoover there was a swelling in the right infraclavicular region, which was reddened and slightly elevated above the surface. This was puckered in several places from old cicatrices, and was pierced by several sinuses which discharged a small amount of thin pus.

The right thorax showed, on examination, the retraction, dulness, absence of fremitus, and feeble respiratory sounds incidental to a greatly thickened and retracted pleura. This proved to be the condition at autopsy.

The patient had been in the habit of wearing his shirt-collar open, and it is thought that he infected some small, unnoticed, external wound. He died from myocardial exhaustion. Residence, Cleveland.

CASE XXXVIII.—Justus Ohage (*loc. cit.*). Patient was a stone-mason, aged twenty-nine. For about a year he had cough and pain in the chest. Abscesses and fistulæ formed at the site of the pain. Integument destroyed over the left chest, in the mammary line, from the fourth to the eighth rib. There was considerable swelling pierced by fistulous tracts with bluish flabby edges. Between these there was broken-down tissue and angry fungoid masses. The ribs were roughened and necrotic. Over this area there was dulness and a few crackling râles. A sound introduced into the fistulæ entered about four inches.

Ribs were resected and extensive cauterization done. In about a month the patient was sufficiently recovered to go home from the hospital.

Three months later the disease recurred and patient died. Residence, St. Paul.

CASE XXXIX.—Roswell Park (*Buffalo Medical Journal*, 1892, pp. 326-337). Patient was a male, thirty years of age, who had been employed two and a half years before as clerk in the stock-yards, where he occasionally came in contact with cattle.

He had seen a couple cases of "lumpy-jaw." While at the stock-yards he developed a cough and became weaker. He changed his place of business, but was not improved. Symptoms increased, and a lump appeared over the liver in the right axillary line. His physician told him it was "callus" from a broken rib. This softened and was removed. The pus contained sulphur granules. When seen by Dr. Park there was a large mass of indurated tissue over the liver with sinuses. This mass was incised with the resection of three ribs. The bone was involved. Patient died of shock. Residence, Buffalo.

CASE XL.—F. B. Mallory (*Boston Medical Journal*, 1895, 296-300). Patient had gradual failure of breathing power and development of cough. A lump appeared in the epigastrium, and the skin over the left epigastric region became reddened and tense. The abdominal wall was thickened about this, and it was dull on percussion. This abscess opened. Seen three days before death. There was an affection of the lungs regarded as advanced tuberculosis, as it had also been previously diagnosed at another hospital.

At the autopsy there were found to be foci in the lungs, liver (entire liver almost transformed), kidneys, and brain. Culture showed colon bacilli in the lung and liver, and staphylococcus pyogenes aureus in the brain and lungs with a few in the liver and blood. Fungus demonstrated in the tissues after hardening. Residence, Boston.

CASE XLI.—Northrup (*Proceedings of the New York Pathological Society*, 1888, p. 151). A fatal case in a boy from Pennsylvania, without any history showing the source of infection. The lesions were in the mediastinum.

Abdominal Form.—Lesions of the abdominal organs or cavities may result from direct infection, from extension, and from metastases.

Direct infection occurs practically through one channel only,—viz., the alimentary canal. This always occurs from above downward, if we are to credit the statement of Poncet and Bérard, though it is easy to imagine direct infection of the anal orifice in the cases of fistulæ in that region. There are, however, no authenticated cases on record. As might

be expected, infection of the intestinal tract occurs where the movements of the gut are the most sluggish. The favorite site is the cæcum and its immediate surrounding tissue. In Grill's collected cases ("Aktinomykose des Magens und Darms," *Beiträge für klinische Chirurgie*, 1895) there were forty cases where the point of entry was definitely made out. Of these eighteen were of the appendix and the cæcum, eight in the colon, seven in the rectum, six in other portions of the intestine, and one in the stomach. The cases where there was more or less probability concerned gave forty-four in the appendix and cæcum, thirteen by the rectum, and one by the stomach.

The other mode of direct infection is a moot point. Zemann, in 1883, published a case of actinomycosis of the female genitalia, where the infection had taken place through the vagina. There was also a salpingitis. Israel places this along with several similar cases of other authors, among the cases of intestinal infection, believing that they are extensions. There have been no primary cases of actinomycosis reported since then, although numerous cases of extension have been seen. For an example of this type of cases the reader is referred to the case of Gardner, published for the first time later in this paper.

Extension may take place from the thorax, coming through the diaphragm or behind the peritoneum, or, in some cases, the muscles of the abdominal wall may be affected through the interstices between the diaphragm and the costal fascia to the sternum (Poncet and Bérard).

The lesions occurring in the abdominal organs are very numerous. Chiari in one case, at the autopsy, found that the lesion was limited to the mucous coat of the large intestine. The surface being studded with numerous nodules from a half to one centimetre in diameter. This is what probably occurs in most cases to start with, but the nodules are not so numerous. It is possible that the organism may pass through an abrasion which may subsequently heal, and so leave no trace of the point of entry (Barth).

From the intestinal tract the infection may extend into the peritoneum. This is rarely affected throughout, but is more apt to be limited to certain portions adjacent to the affected intestine. The loops of the intestine are matted together, and there are small intervening cavities which are filled with pus of an actinomycotic nature.

The lesions may extend directly into the genitalia in the female, involving the uterus, tubes, and ovaries, or the abscess cavities may open directly into the vagina.

The opening may and frequently does take place directly through the abdominal wall. This extension may cause a fecal fistula. These have been described as opening usually in the neighborhood of the umbilicus or in the iliac region. Intestinal vaginal or intestinal vesical fistulæ from this cause have not been reported. The extension may not reach the surface, but may remain with its fecal contents and become encysted.

The urinary tract may be involved by direct expansion. These cases have occurred both from the appendicular form of the disease and from the rectal form. In Billroth's case the sulphur granules were found in the urine, although there were no other signs of cystitis except the pus in the urine. In the kidneys direct extension is not so frequent as in the bladder, but the metastatic processes are more numerous. In some cases the disease appears as a perinephritic abscess. The prostate gland has been involved.

The liver presents some of the most interesting lesions. These are always secondary. There is no authentic case of primary actinomycosis of the liver on record. It may be affected either by direct extension or by metastasis. In thirty cases collected by Aribaud twenty times the lesion came from the intestine, eight times by direct extension, and twelve times by metastasis.

The nodules in the liver vary in size from that of minute points to that of almost the entire liver. Several authors have figured the very characteristic appearance of the nodules in this locality. The appearance is very striking, and once

seen is never forgotten. At the autopsy on Latimer's case, at which I assisted, there was found to be one large nodule, involving almost all of the right lobe (the liver was enlarged) besides several smaller ones. The nodules have the appearance of a sponge filled with purulent matter; or, as another author has said, like a honeycomb,—the connective tissue part being the comb, while the purulent material in the interstices being the honey. The color is grayish-green. Langhans has described a case as being like lung-tissue in which there were numerous small abscesses.

The appendiculo-cæcal form has been studied by Hinglais ("Thèse de Lyon," 1897, quoted by Poncet and Bérard). In one hundred cases of the abdominal form it was found in sixty. He describes the disease in this locality as having four stages,—period of visceral symptoms, period of tumor, period of fistula, and period of reparation.

In the first period, which may last from a few days to several months, there is usually some intestinal disturbance of more or less general nature, diarrhœa, with the passage of numerous stools, in which may be blood and mucus accompanied with tenesmus and pain. The diarrhœa is generally resistant. There may be rarely a period of constipation instead. At this time there are no appreciable signs of the disease demonstrable either by palpation or by rectal examination. As the second stage is approached there may be made out the localized pain, which is more or less continual, a tumor of unequal resistance can be made out, and if the lesion extends towards the skin it becomes reddened, and a little later becomes a violet blue tint, shading from the centre to the periphery. Volkmann, Boström, and Bernhardt believe that this coloring is diagnostic of actinomycosis. The stage of the tumor may last a varying length of time, and there may be remittances. In Latimer's case there were several well-marked attacks, with intervals of perfect health. The disease may now extend to other organs or it may remain localized. It may become infected with other organisms and extensive abscess-formation take place. It most frequently,

but not necessarily, goes on to fistulæ-formation. These are apt to be multiple. The case may cure spontaneously or yield to the surgeon's interference, or it may go on to a fatal termination or it may remain chronic. The extension may go towards the space of Retzius, it may extend into the lumbar region, or it may involve the psoas muscle and subsequently the hip-joint; it may also open on other parts of the body.

The stomach may be involved. Grill and Israel have both furnished cases of this sort. In Israel's case there was an arc-like induration occupying the right epigastric region, followed by the formation of a fistula. The stomach, when inflated, was adherent to the cicatrix that followed. In Grill's case, which came to autopsy, there was a thoracic abscess with involvement of both lungs. The stomach wall was very much thickened. The muscular coat was furrowed with lines of inflammation extending to the lesion in the thorax.

The duodenum and the ileum may be the primary seat of the disease, but most frequently, when it is found there, it is the result of extension. The colon may be affected. In Hoffner's case the sulphur granules were found in the stools. Ransome is said to be responsible for a similar statement.

The rectal cases are generally attended with a period of mucous diarrhœa accompanied with pain and tenesmus. There is usually an abscess formed, which, opening, leaves a fistula behind that continues to discharge the characteristic pus.

Clinically, Aribaud has divided all the above cases into three large classes.

The hepatic form, including those cases that have been described as primary cases of the liver. These cases have enlarged livers, little pain, and usually but little temperature. The cases in their progress, as a rule, are apt to have constipation and considerable disturbance of the general health. In Langhan's case there was slight jaundice. Heavy pain over the lower ribs has been noted in several cases. It is mistaken for ordinary abscess or tumor of the liver.

The gastro-intestinal form, which includes all the forms gone into above.

The pyæmic form, in which there are chills, sweats, and fevers. Pain, vomiting, and diarrhœa are prominent symptoms when the cases are of this type. The lesions in these cases are not limited to the abdominal organs.

The American cases show many points of interest. In the appendix case of Lange the occurrence of typhoid-like symptoms with the subsequent local symptoms is instructive.

CASE XLII.—Lange (ANNALS OF SURGERY, 1896, p. 371). Patient was a man aged twenty-one years, who had occasional pains down the right leg some three years before present disease. Had an attack of some feverish disease, like typhoid, one year previous. Shortly after had a swelling from below the right iliac crest, which subsequently subsided. Anæmia followed. Later a swelling appeared in the same region. This was opened for a cold abscess. The whole iliac region was infiltrated. Appendix at the bottom of it perforated. There was also a perforation of the colon above. The appendix was removed and the colon resected. Patient recovered. Residence, New York.

CASE XLIII.—F. Lange (*New York medicinische Monatsschrift*, 1894, p. 175). The patient was a woman of fifty, who had been sick for six months with symptoms pointing to appendicitis. The swelling opened near Poupart's ligament, and discharged pus containing the fungus. Result not stated. Residence, New York.

The following case, which I observed from beginning to end, was at first a most typical case of appendicitis. The leukæmia may be regarded as a coincidence. It illustrates the difficulty and, indeed, the impossibility of making the diagnosis in all cases.

CASE XLIV.—T. S. Latimer and W. H. Welch ("A Case of Intestinal and Hepatic Actinomycosis in Man, associated with Leukæmia," *Transactions of American Physicians*, Philadelphia, 1896, p. 328). Patient was a male negro, aged twenty-one. Had appendicitis, three attacks in the same year, as stated in the

report (1895). Variable fever, morning remissions to 98°, 99°, and 100° F.; evening rises to 103° or 104°. Slight chills and sweats associated with these variations of temperature. Liver enlarged. Gradual general anasarca. Pleuritic and abdominal effusion. Varying degrees of pulmonary œdema. "No suspicion of actinomycosis was entertained, nor can I now see, on reviewing the clinical history, anything that could have suggested such a condition." Liver was punctured several times for abscess, but without result. Typical splenic myelogenous leukæmia, found on blood examination. Patient was given iron and arsenic.

Autopsy.—Actinomycotic nodules found in the liver, appendicitis of actinomycotic origin, and entire ascending colon involved in a mass of actinomycotic tissue. Residence, Baltimore.

CASE XLV.—J. B. Murphy (published for the first time). An intestinal case, involving the appendix, with the usual symptoms of appendicitis. The disease extended so as to involve the abdominal wall. Sex and age not stated. The diseased tissue was thoroughly curetted, and the patient recovered. Residence, Chicago.

CASE XLVI.—E. W. Lee (published for the first time). A case involving the right iliac fossa. The exact origin of the disease could not be determined. The diseased tissue was removed several times with the curette. When last heard of was nearly healed. (I am indebted to Dr. Murphy for the above information.) Residence, Chicago.

The extensive involvement of the liver is illustrated in the following case:

CASE XLVII.—Kneer and Conrad ("A Case of Actinomycosis," *Boston Medical and Surgical Journal*). Patient was a German merchant. Illness began with pain and swelling in the right hepatic region. Exploration revealed pus which contained actinomycetes. Syringed out with bichloride 1-2000 and boric acid solution. Pyæmia and death from pneumonia.

Autopsy.—Well-marked lesions of actinomycosis. Seemed first to have attacked the intestinal canal and then the liver. Liver weighed nine and a half pounds, and was studded with foci of the infected tissue. Greater part of the left lobe was in a gangrenous condition. Residence, New York.

CASE XLVIII.—William Moser (*New York Medical Journal*, 1894, p. 176). Patient died at St. Catherine's Hospital, in Brooklyn. Autopsy revealed extensive actinomycotic lesions. These were principally in the liver. There was a broncho-pneumonia and the lower lobe of the lung was involved. A few abscesses in the spleen. Liver studded with innumerable miliary abscesses. Sulphur granules easily demonstrable. Residence, Brooklyn.

The following cases show what may sometimes be accomplished by persistent treatment. The patients were given up, but the treatment was persevered in for a number of years, and finally resulted in a cure.

CASE XLIX.—Lange (*loc. cit.*). Patient was a female, aged forty-three. Some years before had an abscess which opened in the vagina and also on the abdominal wall near the umbilicus. Healed transiently. Case seen, seven years ago, with Dr. A. Mayer. At that time she presented a wide-spread destruction over the left gluteal region and hard fibrous tissue in the left iliac fossa. At present there is extensive scarring, suggesting syphilis or tuberculosis. The treatment consisted in injections of solutions of nitrate of silver and zinc nitrate and the local application of silver nitrate. Residence, New York.

CASE L.—Lange (*loc. cit.*). Patient was a man who had his anus surrounded by a mass containing multiple foci. One focus was removed from the region of the coccyx quite close to the intestinal wall. The intestine was shut off from the diseased tissue by a mass of cicatricial tissue half an inch thick. The diseased tissue was removed and the patient recovered. Residence, New York.

CASE LI.—Lange (*loc. cit.*). Patient was a male who had periproctitis, after which the disease was silent for four years. He was operated on several times, and only one small sinus persists at time of report. Residence, New York.

The following cases show what may occur when the disease manifests itself in the beginning with tumor-like lesions:

CASE LII.—Parker Symms (*ANNALS OF SURGERY*, 1897, p. 155). Patient was a female, aged sixty. She was very emaci-

ated and had the appearance of one having a malignant growth. Disease began four years previous. First symptom was pain in the abdomen, followed by swellings. These softened and subsequently opened. Some of them scarred. Had two fistulæ surrounded by indurated tissue, and discharging pus. She had no fever, except when there was a damming up of the pus, owing to closure of the fistulæ. Sinuses were scraped out, but the disease persists. Iodide of potassium was given internally. Residence, New York.

CASE LIII.—S. J. Mixer (*Boston Medical and Surgical Journal*, 1895, cxxxii, p. 303). Patient was a male, aged sixty, who had a small tumor in the median line, just below the umbilicus. On incision omentum and intestine were found in the mass. All the diseased tissue was removed as far as the submucous coat of the intestine, and the patient was improving. Residence, Boston.

The following case is of great interest, as it shows that the disease may cause a perforation of the gut, followed by rapid death, and also that the disease must be distinguished from malignant growths of the stomach:

CASE LIV.—Justus Ohage (*loc. cit.*). The patient was a merchant, fifty-six years of age, who had been suffering with indigestion and pain in the stomach for several months. There was slight discoloration of the skin and slight loss of flesh. In one month he had marked cachexia. Lost flesh gradually and had pain in the epigastric region, but no tumor.

He was suddenly taken with severe pain, which was relieved by anodynes. A few hours later had a sudden attack of sharp pain, and he died three hours later in intense agony, with symptoms of intestinal perforation.

The peritoneum, particularly the greater omentum, was greatly thickened and disorganized. The stomach and pylorus were in the same condition, as was also a portion of the ileum. Everything in the region of the stomach was matted together. There was an opening in the ileum about one inch in its greatest diameter. *The liver was normal.* The condition looked somewhat like tuberculosis, but was diagnosed correctly on microscopic examination. Residence, Minnesota.

The following case presents a number of interesting features:

CASE LV.—J. B. Murphy (*loc. cit.*). Patient was taken suddenly with pain in the abdomen and vomiting, but no diarrhoea. This continued for five days. Great tenderness of the abdomen following this. On admission to the hospital, two days later, the following condition was found. Patient well nourished, eyes somewhat sunken, heart-sounds normal, absence of vocal fremitus and respiratory sounds, up to the fifth rib in the left midaxillary line, abnormal to the bottom of the lung in front and behind, otherwise respiratory sounds normal. Abdomen considerably distended and tender. No cough; urine normal. A couple of weeks later exploratory puncture in the eighth intercostal space, in the posterior axillary line, gave pus. Case transferred to Dr. Murphy. A few days later another puncture gave a dark-brown pus containing characteristic sulphur granules. The eighth rib was resected and the opening enlarged with the thermo-cautery. About a half-pint of pus escaped, and there was considerable *débris* of blood-clots and actinomycotic tissue in the cavity. A large drainage-tube was inserted and patient grew steadily weaker for nine days, when he had a hæmorrhage from the cavity, and died.

Autopsy.—Left lung adherent from the fourth intercostal space down to the base. Tube found to pass through the compressed and adherent lower lobe of lung, through diaphragm, into the abscess in the abdominal cavity. The abdominal cavity contained no fluid. On lifting off the parietal peritoneum there was an opening, one inch in length, through the omentum, between the transverse colon and the stomach, extending into the abscess-cavity. The omentum around this opening was densely, and over its entire surface more sparingly, studded with pale-yellow flakes, about one-eighth of an inch in diameter. They resembled very much flattened grains of wheat. The spleen was found floating in the abscess-cavity, supported only by the vessels at its hilus. It was normal. The liver and kidneys were also normal. There was no evidence of any opening, either in the stomach, through which the fungus must have passed, or other viscera. Residence, Chicago.

The pelvic organs may be affected by the disease, as stated above, and the following case is a good example, and a most interesting history of such a case:

CASE LVI.—W. S. Gardner, Baltimore (published for the first time). The patient was a married woman, aged thirty. She dated her illness from about Christmas, 1896, when she had a severe cold, followed by suppression of menses. About the first of the year (1897) she was seen by Dr. Rex, who found that she was suffering great pain in the pelvis, the pulse was rapid and feeble, and the temperature 103° F. Excessive tenderness prevented a thorough physical examination, but it was noted that there was some distention of the abdomen, and that the pelvis was blocked up with a dense exudate. A diagnosis of pelvic peritonitis was made, and treated accordingly. In another week the exudate had so completely blocked the pelvis as to obstruct both bladder and rectum. About three weeks from the beginning of the attack her temperature was 104.5° F., she complained of pain in the right iliac region, and a tumor, about the size of an orange, could be made out in that region. There was also considerable abdominal distention and tenderness. From this apparently desperate condition she rallied until she was able to sit up and be moved. In about four months' time, when again seen, she had much less pain and temperature, but she retained marked symptoms of pelvic disease. She was able to sit up a part of the time. Following this there was no great change in the local condition, but she grew progressively weaker.

Six months after the beginning of the attack Dr. Gardner was called in consultation, and he found a pulse of 120, a temperature of 101° F., the body much emaciated; abdominal wall depressed but tense; through the vagina it could be determined that there were many pelvic adhesions, but no tumor could be felt. A diagnosis of tubercular peritonitis was made, and it was advised that a laparotomy be done. In opening the abdomen the tension on the tissue was so great that, in cutting, the layers of fascia snapped and cracked under the knife. The general peritoneum was healthy, but the pelvic contents such a mass of adhesions that it was with the greatest difficulty that anything definite could be made out. The uterus was found, and close to it, on the right side, was found a rounded mass about the size of a small

hen's egg, and which was thought to be the right ovary. It was enucleated from its bed and removed. No vessels were tied. Pus in small quantities exuded from the mass at several points. The patient died twenty-four hours later. Residence, Waterford, Va.

The specimen removed was submitted to me for examination. It was a tumor-like mass, an irregular spheroid in shape, the largest diameter being about six centimetres. On section it presented a yellowish-green appearance, and consisted of a structure of connective net-work whose interstices were filled with a thick, creamy, yellowish pus, containing small granules varying in size from that of a millimetre in diameter to so small that they could scarcely be seen by the naked eye. These granules were of a sulphur yellow for the most part, but some were lighter, and approached white in color. The whole mass appeared to have a thin sheath of connective tissue, and suggested an ovary which had been invaded by the streptothrix actinomycotica. On being placed in alcohol and hardened the so-called honeycomb structure was very apparent.

Under a low power the sulphur granules seemed to be granular, but had no other distinguishing features. Under the oil immersion lens they were seen to be made up of a mass of tangled threads. The centre of the masses being so thick as to be unresolvable, but at the edges, particularly in the teased specimens, the streptothrix threads could be made out plainly, and also numerous coccus-like bodies mingled in the meshes. The appearance was much plainer after the specimens were tinged with eosin.

On section the tumor-like mass was found to be made up entirely of actinomycotic tissue. Irregular bands of connective tissue, with elongated pointed nuclei, traverse the field, crossing and recrossing, forming the honeycomb structure alluded to above. In this case the connective-tissue bands were pretty thoroughly invaded with small round cells, arranged in more or less regular rows in some places, while in others they were massed together without any order. These grew more numerous at the edges of the bands, and the connective tissue grows less, and the round cells more numerous until a zone is seen consisting entirely of small round cells of the lymphoid type with some epithelioid cells, and here and there a giant-cell. Very small fibres of connective tissue traversing the zone hold it together. In many

cases this zone surrounds only an open space, the centres having dropped out in the preparation of the specimen. Where they are perfect, however, the centre is found to be a small mass of the streptothrix surrounded by a small zone of polynuclear leucocytes. Where the centre is above or below the section the mass of streptothrices is wanting, and the centre is only made up of the leucocytes. The fungus does not stain well with hæmatoxylin, but has a very suggestive appearance in spite of the fact that it cannot be differentiated. By Gram's method the streptothrix is brought out very beautifully. It is found to be rather regularly distributed through the tissue. In some places the colonies are small, and in others very well developed masses are seen. Some of these are in the complete circles and some in the almost complete circles mentioned in the description of the parasite. The edges of the colonies present perfect pictures of the streptothrix. The branching of the threads and the coccus-like bodies being very well marked. There are no clubbed ends in this specimen. Mallory's method was used in numerous sections from different levels, but they were all negative. There is no ovarian tissue in the specimen.

(To be concluded.)

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 10, 1899.

The President, ANDREW J. MCCOSH, M.D., in the Chair.

APPENDICITIS WITH PUS FREE IN THE PERI- TONEAL CAVITY.

DR. FREDERIC S. DENNIS presented a boy who was first seen by him forty-eight hours after the onset of an attack of appendicitis. His temperature then was about 100° F.; the pulse was less than 100, and the patient's general condition was so comfortable that it was at first thought advisable to wait longer. There was, however, a good deal of tympanites, with a history of vomiting during the afternoon, and on this account an immediate operation was undertaken. Upon opening the abdomen the appendix, cæcum, and part of the ileum were found to be gangrenous. The cavity was washed out with peroxide of hydrogen, and then packed with sterile gauze. About a week afterwards the boy passed a cast of the cæcum, which proved, under the microscope, to be the peritoneal coat of the gut. The wound gradually closed, and there is not even a fæcal fistula left.

A second patient was shown by Dr. Dennis, a young man who was operated on by Dr. Bissell, assistant surgeon to St. Vincent's Hospital; also a third patient, a young girl, and a fourth, a woman. In all of the cases pus was found free in the peritoneal cavity. In the last two cases shown the appendix was not removed. Both healed up without any trouble after some length of time, during which the wound was kept open, and both patients recovered without a hernia. The abdominal cavity was washed out daily with peroxide of hydrogen and then with saline solution, and the wound was packed with a little sterile gauze. These cleansing methods were repeated from time to time during the following ten days, or until the wound had completely closed.

DR. B. FARQUHAR CURTIS said that during the past year he had in two operations for acute appendicitis found a collection of pus in the peritoneal cavity, in which the pus was not bound in by adhesions, but was limited in one fossa, and there was no general peritonitis. In one of the cases the pus lay between the cæcum and the right abdominal wall, and in the other case it was limited by the surrounding coils, but without adhesions.

Dr. Curtis said the excellent results in Dr. Dennis's cases were possibly due to the fact that a general peritonitis did not exist, although the pus was not limited by adhesions.

GASTROSTOMY.

DR. DENNIS presented a man who had already been shown about a year ago, and was again presented to demonstrate the perfect condition of the wound at the present time. The operation had been done for a stenosis of the œsophagus, due to a typhoid ulcer, which is a very rare condition.

At the time of the operation the man was in very poor condition; he was cyanotic, weighed less than 100 pounds, and was being nourished entirely by means of rectal enemata. Since the gastrostomy the patient has gained eighty-five pounds in weight and has enjoyed perfect health. The gastrostomy wound has a perfectly healthy appearance. There is no œdematous condition about the orifice; the man can remove and insert the tube without any trouble; there is no regurgitation, and no leakage when the tube is out. He is able to take no nourishment whatever through the mouth. The operation was done about two years ago.

DR. WILLY MEYER said he had done gastrostomy by Marwedel's method a number of times, but always for the relief of cancerous conditions of the œsophagus, so that none of his patients had lived as long as the man shown by Dr. Dennis, where the operation was done for a benign stricture of the gullet. Dr. Meyer said that certainly the functional results of this operation were all that could be desired; it was simply ideal, especially as the patient can remove and replace the tube at will, and there is no leakage. In those patients who have a thin-walled stomach, care should be exercised, when performing Marwedel's operation, not to leave the tube in longer than two or three days; otherwise,

unless the tube is very soft, the sero-muscular coat of the stomach, which had been originally incised, may again become divided. The speaker said he had seen this accident occur in one instance. The patient, who was much emaciated, had been left to the care of the house-surgeon. The tube was not removed before the seventh or eighth day. About a week after the operation a rent of considerable size was found in the stomach wall, which gave rise to much trouble. In these thin-walled stomachs the tube should be removed not later than the third or fourth day, and then reintroduced before each feeding.

Dr. Meyer said he was interested in the perpendicular course of the fistula in Dr. Dennis's case. The same is found in Witzel's operation, where, although an oblique incision is made, it gradually becomes perpendicular in the course of time. In the operation of Kader a large tube can be inserted immediately and the rest of the wound closed, as in an ordinary laparotomy wound. This gives us a large-sized tube, through which the patient can be fed at once. The functional result of this operation is always very good. In Kader's operation the tube must be left in place, as the fistula is apt to close very rapidly. Both of the operations can be highly recommended. If it is desirable to get the patient out of bed and hospital as quickly as possible, Kader's operation is preferable, otherwise, Marwedel's can be highly recommended, although it requires more prolonged after-treatment.

PERFORATING ULCER OF THE DUODENUM.

DR. A. B. JOHNSON presented a man, aged twenty-seven years, who was admitted to Roosevelt Hospital at three o'clock in the morning, March 28, 1899, with the history that four days before admission, having been up to that time in good health and free from digestive disturbances, he was seized with colicky pains referred to a point above the navel, and to the right of the median line. There was no vomiting and he did not have a chill. His pains were not severe, but they continued during the following two days, and were always referred to the same region. His bowels moved daily and he remained at his work. At 1.30 A.M. of the day of his admission he was awakened by severe abdominal pains, which were most intense three inches above the navel and a little to the right of the median line. They were followed by a chill which lasted half an hour. There was no nausea,

but the patient took a dose of mustard and water, which induced free vomiting, the vomited matter consisting of partly digested food and the mustard and water which had just been taken; no other ingredients were noted. He felt feverish, and the pain was so intense that he sent for an ambulance and was brought to the hospital, arriving at 3 A.M.

When admitted his abdomen was not distended, but was moderately tender, with well-marked muscular rigidity throughout. The tenderness was most marked over an area about two inches in diameter, located three inches above the navel, and with its centre one and one-half inches to the right.

A small dose of morphia was then given hypodermically for the relief of his pain. At 10 A.M. his pain was somewhat less severe, the tenderness more marked and localized, as before. There was general rigidity of the abdominal wall. His temperature had risen to 101.5° F.; pulse, 80; respirations, 20. The diagnosis was made of an acute intra-abdominal inflammation, probably of a suppurative character, upon the right side of the abdomen, its exact anatomical situation being unknown. At 11.30 A.M. the abdomen was opened by an incision, two and one-half inches long, in the right semilunar line, with its centre at the level of the umbilicus. Upon opening the cavity of the belly a considerable quantity of cloudy, bile-stained fluid, containing flakes of coagulated lymph, escaped. The probable diagnosis of perforated ulcer of the duodenum was then made: as a matter of precaution, however, the vermiform appendix was sought for, and was found to be normal. The incision was extended vertically upward to the free border of the ribs. The large and small intestines, the gall-bladder, the under surface of the liver, and the anterior wall of the stomach showed evidences of acute irritation, and were coated here and there with patches of grayish lymph. Upon the anterior surface of the descending portion of the duodenum, a little to the right and about midway between the junction of the first and second portions, at the point where the second part passes behind the transverse mesocolon, was seen a rounded or oval perforation, large enough to admit a No. 26 French sound, or thereabouts, through which was escaping bile mixed with other intestinal contents. The border of the ulcer was clean cut, not ragged. A pad of gauze was held over the ulcer, and the neighboring portion of the abdomen was thor-

oughly washed with salt and water. The opening in the duodenum was encircled with a purse-string suture of catgut, the edges of the ulcer were inverted into the intestine, and the suture was tied. The closure was further strengthened, and the tension upon the purse-string relieved by four Lembert stitches of catgut, introduced along a line parallel with the axis of the gut. The remainder of the greater peritoneal cavity was then examined. A considerable quantity of bile-stained, cloudy fluid was found at the bottom of the pelvis, and the intestines were everywhere moderately reddened and coated with disseminated patches of lymph. The edges of the wound were held wide apart, and the entire abdomen was repeatedly flushed out with hot water and salt, without evisceration, the fluid being gently stirred about with the hand in the abdomen. The entire cavity was wiped dry with large pads of sterile gauze. A strand of gauze packing was then introduced down to the site of the ulcer and brought out at the upper angle of the wound. The remainder of the wound was then closed with sutures. The patient did not suffer from shock. He was fed *per rectum* for forty-eight hours. His temperature, on the day following the operation, rose to 101° F., after which the elevations of temperature were trifling. The superficial wound was dressed on the third day, and appeared to be slightly infected. The skin sutures were thereupon removed. The deep packing was removed on the fourth day, and was found to be clean. Excepting the superficial infection of the skin wound, which necessitated the prolonged use of adhesive straps in order to encourage union of the skin edges, the patient's convalescence was unimportant. He remained in bed four weeks after the operation, and at the present time, six weeks after the operation, he appears to be in the best of health.

Dr. Johnson said that through the courtesy of Dr. Robert F. Weir he was able to present the following statistics regarding cases of duodenal ulcers. Out of thirty-nine cases on record, there were eight recoveries; in twenty of these cases the ulcer was not recognized; two were thought to be cases of general peritonitis; thirteen were looked upon as cases of appendicitis, and three as cases of intestinal obstruction. In nineteen cases where the ulcer was found—though not diagnosticated beforehand—there were six recoveries. Dr. Johnson's case, just reported, was the second case of recovery in this country, the first one being that of Dr. Taylor, of Richmond, Va.

DR. L. A. STIMSON referred to a case which he had seen at the Hudson Street Hospital, about a year ago, as an illustration of the rapidity with which symptoms may develop after perforation and of the impossibility of an exact anatomical diagnosis. The patient was a man who, after having retired apparently in perfect health, was seized during the night with severe pain in the abdomen. Dr. Stimson saw him at ten o'clock the following morning shortly after he had been brought to the hospital. At that time his condition was one of extreme gravity; he was unable to give any account of himself beyond the statement that he had been well the day previous, and was suddenly seized with a severe pain during the night. The abdomen was distended, tympanitic, and uniformly sensitive. A diagnosis was made of an intra-abdominal lesion of unknown character, possibly appendicitis, and the abdomen was opened over the region of the appendix. As soon as the peritoneum was opened there was a gush of odorless gas: this established the diagnosis of a perforation of the stomach or duodenum. The man's condition was such that further exploration had to be abandoned; he died in two hours. The autopsy showed a perforation of the duodenum.

BULLET-WOUND OF THE STOMACH AND SMALL INTESTINE.

DR. A. B. JOHNSON presented a man, aged thirty-five years, who was admitted to the Roosevelt Hospital on the afternoon of April 2, 1899, at 5.40 o'clock, with the history that one hour before he had been approached by another man who pushed a 38-calibre revolver against the front of his abdomen and fired the contents of the weapon through his body.

The wounded man preserved sufficient strength to get into a cab, which happened to be near, and was driven at once to the Roosevelt Hospital. Upon admission the patient was seen to be a man robust and evidently in the most perfect physical condition. He was fully clad, and wore an overcoat, through the front of which over the abdomen was a hole burned an inch or more in diameter, with corresponding perforations in his coat, waistcoat, shirt, and under-shirt. When undressed and placed in bed, a 38-calibre, conical, lead bullet dropped out of his clothing. Considerable hæmorrhage had occurred from a wound of exit in his back. He appeared to be suffering from shock and hæm-

orrhage; he was pale. His temperature was subnormal, 97.2° F.; pulse, 88, soft and compressible; respirations, 22.

He complained of intense distress in the abdomen and begged for relief. Examination of the abdominal wall in front showed a powder burn, and a ragged perforation in the skin at its centre, situated three inches below the ensiform cartilage and one inch to the right of the median line. The powder burn was quite superficial and about one inch in diameter; this wound did not bleed.

Upon examining the patient's back the wound of exit was seen to the left of the median line, and four inches from it, just above the posterior superior iliac spine.

The wound of exit was small and when examined had ceased to bleed. At 6.25 P.M., about one hour and forty-five minutes after the receipt of the injury, under ether, an incision was made in the median line of the abdomen, from a point two inches below the ensiform cartilage, downward to an inch and a half below the navel. Upon opening the abdominal cavity a large amount of fluid blood escaped. The stomach presented in the wound. A perforation was found in its anterior wall near the lesser curvature and about two inches removed from the pylorus. An artery of some size at the edge of this perforation was bleeding freely, and was ligated. The muscular coat was denuded of peritoneum around the borders of this hole, forming a solution of continuity in the latter membrane of the diameter of one inch. The mucous membrane showed a ragged everted border, and from the cavity of the stomach bile-stained stomach contents and gas were freely escaping. This perforation was closed by two purse-string sutures, one outside the other, and the closure reinforced by five mattress stitches, all of catgut. The gastro-colic omentum was then torn through, the hand inserted into the lesser peritoneal cavity, the stomach dragged out through the rent, and its posterior surface examined.

A perforation similar in character to that upon the anterior surface was found about one and a half inches from the greater curvature, and much farther to the left than the anterior perforation. From it also stomach contents were escaping. It was closed by suture in the same manner as the anterior perforation, but with rather more difficulty. The rent in the gastro-colic omentum was held widely open, and the lesser peritoneal cavity

repeatedly flushed out with hot sterile salt solution; afterwards it was wiped dry with large pads of sterile gauze. Search was then made for intestinal perforation; it soon became evident that the question of hæmorrhage required immediate attention. The manipulations having evidently caused an increased amount of bleeding of the most serious character.

At this time the patient's color, breathing, and pulse underwent a sudden change for the worse, and blood welled up from among the coils of intestines in a manner which rendered a decision as to its source somewhat difficult. After a few moments, search a jagged tear was found in the mesentery of the first coil of the jejunum, about five inches below the insertion of Treitz's ligament, and close to the border of the gut. Several vessels in the borders of this wound of the mesentery were bleeding rapidly. The contused edges of this wound rendered the use of ordinary hæmostatic forceps difficult, and the edges of the tear were therefore surrounded or included in three catgut ligatures passed by means of an aneurism-needle.

Opposite to this wound of the mesentery the jejunum was perforated, and from the hole intestinal contents were escaping. The long axis of the perforation lay transversely to the calibre of the gut.

The wound was closed by a row of Lembert stitches inserted in a line at right angles to the axis of the intestine. An inch and a half from this perforation the intestine had been scored by the bullet for a distance of two and a half inches, in such a manner as to split the peritoneal covering of the gut, laying bare the muscular coat over a considerable area. The edges of the torn peritoneum were stitched together, thus closing the rent. Fine catgut was used on all the sutures.

The injury to the mesentery lying close to the intestine and immediately opposite to the site of the intestinal perforation would, in the then opinion of the writer, have demanded a resection of that portion of the bowel, but, in spite of stimulation of the most active kind, the patient's condition at this time forbade any further operative measures. He was pulseless with dilated pupils, the tension of the eyeballs reduced, and the breathing shallow, infrequent, and gasping.

While the latter part of the operation was going on preparations were made for intravenous infusion of salt solution. It re-

quired some persuasion on the part of the writer to induce the house-surgeon to make this infusion, because, he said the man did not bleed, his veins were empty, he had no pulse, he had ceased to breathe, and was therefore dead. The infusion was commenced, and after some 400 or 500 cubic centimetres of hot water and salt had been added to the patient's circulation, signs of returning vitality were evident. The infusion was continued until 1800 cubic centimetres had been given, at a temperature of 118° F.

When the infusion was finished the patient was breathing regularly, he had a pulse of 120, and of fair quality, and his color was much improved. While the infusion was being administered the abdominal cavity was repeatedly flushed with hot sterile salt solution, all fluid blood and clots were removed, and the cavity wiped dry with sterile pads. A strand of gauze was carried down to the site of perforation in the jejunum, and brought out of the upper angle of the wound.

While flushing the abdomen a wide rent was found in the inner edge of the descending mesocolon, through which three fingers could be introduced through the muscles of the back to the wound of exit in the skin. This wound did not bleed, and was merely washed out and wiped dry with gauze. The wound in the transverse mesocolon, through which the bullet passed after leaving the stomach and before entering the jejunum, did not bleed, and therefore its exact position was not noted. The wound was closed by layers with buried catgut and superficial silk stitches. The time from the beginning of the anæsthesia until the patient was removed from the operating table was one hour and ten minutes. Following the operation the patient was stimulated with strychnine and digitalin, one-thirtieth and one-fiftieth of a grain respectively, every two hours. He received enemata of coffee and whiskey, and to relieve thirst, and to replace as far as possible the loss of fluids, he was given enemata of normal salt solution, a quart at a time, every six hours. For the first four days he received nothing by mouth but small doses of hot water.

On the day following the operation his temperature rose to 101.4° F. By the end of the second day his pulse had fallen to 80, and was of good quality.

Soon after the operation the patient began to suffer from

severe and continuous hiccoughs, which could only be controlled for a few hours at a time by full doses of morphine; he vomited, at intervals, during the first five days considerable quantities of dark chocolate-colored fluid. This vomiting was treated upon the fourth day and thereafter by frequent washing out of the stomach with warm water, which rendered the vomiting less distressing and diminished the severity of the hiccoughs. Upon the fourth day the gauze drainage was removed from the abdomen and appeared clean. The external wound remained aseptic.

Upon the fifth day the amount of vomiting appeared to be increasing, the patient was suffering from severe abdominal pain and hiccoughs, his temperature had risen from normal to 100.6° F., his pulse had become rapid and more feeble. Owing to these symptoms, which seemed to show that there was a constant regurgitation of intestinal contents of the stomach, and owing to the supposed feeble nutrition of the gut at the site of the perforation in the jejunum, on account of its diminished blood-supply, it was feared that the intestine might have undergone necrosis at this point, and for these reasons the patient was again etherized upon the evening of the fifth day, the upper part of the abdominal wound was opened, and the jejunum and mesentery at the point of injury were carefully inspected. No adhesions except of the slightest character were found. The belly was dry, the uppermost coils of small intestine appeared flabby, slightly reddened, but not distended.

The site of the wound of the mesentery could only be distinguished as a moderately reddened depression, close to the border of the gut. At the point of perforation in the gut itself could be seen merely a very slight reddened projection, to which a minute portion of catgut adhered. The stomach was not inspected. The wound was closed with sutures.

Upon the day following this operation the patient's temperature rose to 102.4° F. He continued to vomit and to hiccough. After each washing of the stomach he was fed with beef-juice by the mouth. In the afternoon of that day he was given calomel in divided doses, which was effective on the day following, after which his general condition was greatly improved.

His temperature and pulse soon fell to normal; he ceased to vomit; the hiccoughs persisted, but grew less intense and with remissions. Although the wound in the abdominal wall remained

entirely aseptic, yet the superficial portion of the wound at its upper part failed to unite completely by primary union after it had been resutured, necessitating the use of straps and stimulating applications. The patient was allowed to get up out of bed upon the nineteenth day, since when his convalescence has been rapid, except for occasional attacks of indigestion, brought about by the incautious use of food. He is rapidly regaining his physical strength, and to-day, thirty-eight days after the injury, he is able to eat heartily and to walk several miles without undue fatigue.

DR. JOHNSON remarked, as to the lesion in the mesentery, that in severe injuries of the mesentery close to the border of the intestine, we are usually told that the anatomical arrangement of the vessels of the gut is such that in all probability a portion of the intestine will slough. This complication, Dr. Johnson said, he feared in his case, and that it did not occur rather disproved the popular belief that the vitality of the gut depended to a serious extent upon the patency of the vessels close to its border. In the case he had shown the hole in the mesentery was large and jagged, and after several unsuccessful attempts to catch the bleeding vessels, the entire area was surrounded by ligatures with an aneurism-needle. Five days later this injury to the mesentery could only be recognized by the dimple which remained, and the vitality of the gut was unimpaired.

Dr. Johnson said he had never before seen a case which illustrated so strikingly the value of saline infusion. It was almost like a resurrection from the dead.

APHONIA FOLLOWING EXTIRPATION OF GOITRE.

DR. A. J. McCOSH presented a woman, who had been operated on by him about two months previously for the extirpation of a moderate-sized goitre. For some time previous to the operation the woman had suffered from dyspnoea and aphonia; since the removal of the goitre, which was confined mainly to the left side, the dyspnoea had entirely disappeared. A strip of gauze was used for drainage, and left in for fifteen hours. The wound closed by primary union. Immediately after the operation the patient gained complete control of her voice,

but soon after leaving the hospital (on the ninth day after operation) her hoarseness reappeared and steadily grew worse until now her voice is exceedingly husky.

Dr. McCosh said he would like to ascertain the cause of the aphonia in this case. She had been examined by a laryngologist, who reported that the left vocal cord was useless. It did not seem likely, the speaker said, that the operation for removal of the tumor, the pressure of which had caused the aphonia previous to the operation, could have produced any injury to the nerve, because the aphonia had disappeared for about two weeks immediately after the operation. It was possible, he thought, that the recurrent laryngeal nerve was nipped in the cicatrix of the wound on the left side, or pressed upon by the cicatrix. He questioned whether it would be wise to open up the scar in order to see if any cause for the hoarseness could be found.

Dr. HOWARD LILIENTHAL thought the condition was possibly due to a neuritis, and suggested the use of aconitia. He also suggested that thiosinamin might be given a trial.

SARCOMA DEVELOPING TWENTY YEARS AFTER INJURY.

Dr. F. H. MARKOE reported this case, and showed the specimen removed. This consisted of a spindle-celled sarcoma of the thigh, which had developed in the cicatrix of a burn twenty years after the receipt of the injury. The inguinal glands had become involved and were removed.

CHRONIC INTUSSUSCEPTION.

Dr. F. H. MARKOE presented specimens, saying that the first case had been under his care for about three years. There had been pain and slight local tenderness in the right hypochondrium, with occasional severe hæmorrhages from the bowels. Recovery from these attacks had been prompt and the general health remained good. Subsequently there was an attack of acute intestinal obstruction, and rectal examination showed just within the sphincter the apex of an intussusceptum. A right inguinal colostomy promptly relieved the acute symptoms. During the following two weeks the intussusceptum protruded six or eight inches from the anus. A few days later the mass was

amputated, the respective layers being sutured. Prompt healing followed. Still further protrusion occurred, however, of about one or two inches, which was gradually receding, when, one month later, it suddenly entirely disappeared after a movement of the bowels. The patient became collapsed and died within twelve hours, perforation having probably occurred at the neck. No autopsy was allowed. At the apex of the excised mass was found an adenoma.

In the second case, under observation for a few months, the symptoms were only of pain and a movable, tender mass in the right side of the abdomen, thought to be a movable kidney. Symptoms of partial obstruction led to an exploratory abdominal incision, which revealed an ileo-cæcal intussusception. The sheath was incised, the mass removed, and an anastomosis made between ileum and ascending colon. The only available button was too large, and perforation occurred at site of junction a few days later. The tumor in this case was also an adenoma.

DIFFERENTIATION OF THE URINES.

DR. F. TILDEN BROWN read a paper with the above title, for which see page 661, December, 1899.

DR. C. L. GIBSON said that Dr. Brown, in his paper, alluded to a case where there had been some doubt as to the accuracy of the result obtained by Harris's segregator. He inquired whether Dr. Brown could suggest any method whereby the accuracy of the results obtained by the use of this instrument could be demonstrated; for example, the use of some colored fluid in one segment of the bladder?

DR. WILLY MEYER said that Dr. Brown's paper demonstrated the value of the Brenner uretero-cystoscope, which he (Dr. Brown) evidently preferred to the Nitze instrument, as he had used the latter only twice. Dr. Meyer said that eleven years ago he had succeeded in catheterizing the ureters with the aid of the Brenner cystoscope; there was some defect, however, in the telescope of the instrument, and he gave up using it, as it could not be repaired in this country. With the Brenner instrument, the observer views the picture through the convex side of the beak instead of the concave, as in the other instruments, and this gives a different picture from the one observed through the Casper or Nitze instrument.

Dr. Meyer said he had done all his catheterizations of the ureters, in recent years, both in the male and female, with the Casper or Nitze instruments: more recently, he had confined himself to the latter only, as he now regarded the perfected Nitze cystoscope as the best instrument of its kind. In his latest pattern, Nitze has adopted the brilliant modification of Albarran, which permits one to give the tip of the ureteral catheter any desired angle. Besides, the field of vision is so very much enlarged that we get a picture which enables even those who are not expert in this line of work to find the ureteral orifices with comparative ease. Leakage, which occurred with Nitze's instrument, in one of Dr. Brown's cases, can be prevented by properly adjusting the small rubber disk which is inserted at the entrance to the channel, designated for the passage of the catheter. Dr. Meyer said that since he has been able to give the tip of the catheter any desired angle, he has never failed to enter the mouth of the ureters, except at times in cases where one of the two was contracted or ulcerated.

As regards the Harris instrument, the speaker said its accuracy could not always be relied upon, and he gave an instance of that kind coming under his observation. With the ureter-cystoscope we have a much more accurate method of finding out the character of the urine secreted by each kidney. The results obtained by means of the Harris segregator should be regarded as approximate, not absolute.

Dr. McCOSH said that, up to a year or two ago, he had felt sceptical regarding the feasibility of ureteral catheterization, but since then he had seen it done so often and with such ease by the reader of the paper, Dr. Brown, that he had become more and more convinced of its practical utility and value. Even in women the cystoscope, as used by Dr. Brown, had seemed to him superior to the cystoscopic tubes of Dr. Kelly.

Dr. ARTHUR L. FISK asked Dr. Brown what position he placed his patients in for catheterization? The speaker said that in one instance, coming under his observation, so much difficulty was found in locating the mouths of the ureters with the patient in the lithotomy position that the knee-chest position was substituted, whereupon the catheterization was completed in two or three minutes.

Dr. BROWN, in closing the discussion, said that in perform-

ing ureteral catheterization he used the modified Trendelenburg position, with the object not only of adjusting his line of vision to the ocular end of the cystoscope, but also to help the patient retain a little more fluid in the bladder. The success of the procedure depends largely upon careful attention to the many details. The height of the table and stool, for example, are important. If the operation is undertaken under unsuitable circumstances, and the eyes must be raised or lowered in order to get on a level with the ocular end of the cystoscope, something is apt to go wrong. Sometimes, with the most careful attention to details, ureteral catheterization is not at all a brilliant undertaking, although in the vast majority of cases it can be successfully carried out.

Dr. Brown said he agreed with Dr. Meyer that the perfected Nitze cystoscope was a complete and beautiful instrument. It possessed, however, certain drawbacks which had led him to believe that personally, at least, he could do quicker and better work with the Brenner instrument. With the Nitze instrument one must decide in advance just what sized catheter will be used, and in case that size does not prove satisfactory, the whole instrument must be removed and readjusted. Another objection to it is that if, after introduction, the metal catheter-carrier should happen to run off its cog-wheel, one cannot get hold of it again, and it would be very painful to withdraw it then; if left undisturbed, it interferes with the vision. Dr. Brown said he regarded the Casper instrument as simpler than the Nitze, and the Brenner still more so. It is easy to introduce and withdraw, and because of its large calibre, it permits one to add a little more water or take out a little, as might seem desirable.

In reply to Dr. Gibson's question, Dr. Brown said he knew of no method which could be employed in order to ascertain whether the Harris instrument was working satisfactorily, so that its conclusions could be relied upon. Where you have a perfectly natural bladder, the information gained through the Harris instrument is usually reliable, but whenever possible, its introduction should be preceded by a cystoscopic examination. The speaker said that in one case coming under his observation the Harris instrument gave positive information that there was occlusion of one ureter, but it did not show how high up the occlusion was; this was afterwards ascertained by means of the ureteral catheter.

Stated Meeting, May 24, 1899.

The President, ANDREW J. MCCOSH, M.D., in the Chair.

GASTROSTOMY AFTER THE METHOD OF KADER.

DR. WILLY MEYER presented a man, forty-three years old, who first experienced difficulty in swallowing in the latter part of December, 1898. He noticed at that time that his food was arrested before it reached the stomach, near the cardia. Subsequently there was regurgitation of food, and finally he could not even swallow liquids.

Gastrostomy was performed by Dr. Meyer on April 15, 1899, the method of Kader being followed. When Kader proposed this operation, in 1896, he stated that he preferred to make the skin-incision parallel to the border of the ribs. Dr. Meyer said he always considered it a great advantage to at once perforate the left rectus muscle bluntly. In the case shown, he made his incision to the left of and parallel with the median line, then bluntly divided the rectus muscle, and incised the peritoneum. The stomach, as is usual in these cases, was much contracted. It was pulled forward into the wound, incised, and a tube inserted for a distance of two or three inches. After insertion of the tube, it was stitched with catgut to the gastric wall; then, outside of this, the tube was encircled with a fold of the stomach, and stitched with silk; this formed the first row of sutures. External to this a second fold was taken and drawn over the first, thus forming two rows of sutures which surrounded the tube. In this way a funnel of serous membrane is formed about the tube. The ends of the outer row of sutures are allowed to remain long, and with these the stomach can be pulled up into the peritoneal wound and held there by means of sutures. Then the muscles and skin are in layers successively closed about the tube. The stomach is thus fastened securely to the anterior abdominal wall, and the patient can be fed at once.

Another advantage of the Kader method is that a much larger tube can be used than, for instance, in Marwedel's operation. The upper end of the incision should be as close to the lower end of the ribs as possible. The patient presented by Dr.

Meyer made a good recovery, and has been steadily improving ever since.

Dr. Meyer said it was now three years since he had presented his first case of gastrostomy by the Kader method to the Surgical Society, and he still regarded it as superior to any other method with which he was acquainted. He admitted that if these patients left out the tube for any length of time, they might find it difficult to reintroduce it. Invariably they preferred to keep the tube in, which causes them no trouble or annoyance.

POSTERIOR GASTRO-ENTEROSTOMY.

DR. MEYER presented a man, fifty-five years old, who was operated on April 15, 1899, for malignant disease of the stomach. In connection with this operation, Dr. Meyer said, much discussion had lately arisen as to whether an additional entero-enterostomy was necessary. The speaker said that, while such an additional step might sometimes be desirable, he did not consider it necessary. Personally, he had performed posterior gastro-enterostomy more than a dozen times, and in not a single instance did he find it necessary to do an entero-enterostomy also. The investigations of Carle and Fantino, the Italian surgeons, have shown that, while bile is present in the stomach even as long as three months after a gastro-enterostomy, it does not interfere at all with the functions of the stomach. This, Dr. Meyer said, had also been his experience. Usually these patients did not vomit; in those cases where vomiting did occur, it could readily be checked by lavage of the stomach.

In anterior gastro-enterostomy, however, the conditions were quite different. There, necessarily, large quantities of bile would often flow into the stomach, and would be apt to give rise to severe gastric symptoms.

Dr. Meyer said that on a number of occasions, in doing a posterior gastro-enterostomy, he had found the transverse mesocolon so short that he had to content himself with the exposure of a very small portion of the posterior gastric wall,—perhaps as large as a silver dollar. In such a case it would be impossible to employ sutures, and the Murphy button was the only means to finish the operation. In all these cases he regarded the Murphy button preferable to the use of sutures.

The patient shown by Dr. Meyer made a rapid recovery.

RESECTION OF EPIDIDYMIS AND ORCHIDOTOMY
FOR TUBERCULOSIS.

DR. MEYER presented a man, thirty-four years old, who, in March, 1898, had his left testicle removed for tuberculosis. The following January his right testis began to swell and soon ulcerated. When he entered the hospital, in April, 1899, it was found that he was suffering from a tuberculous epididymitis on the right side.

As the patient had already lost his left testis, Dr. Meyer said he determined to make an effort to save the remaining one. The organ was brought into view, and with some difficulty the strong adhesions between the epididymis and testis were severed. Then the cord was evulsed and resected, with the epididymis. The testis was then longitudinally incised, as practised in the so-called section out of the kidney, and upon inspection it was found to be healthy; the incision in it was thereupon closed with catgut-stitches through the albuginea, and the organ replaced. The patient made a good recovery.

Dr. Meyer said he presented this case in order to emphasize the fact that by early resection of the epididymis and orchidotomy we might frequently save a testis which would otherwise be sacrificed.

DR. C. L. GIBSON said that, although he had never resorted to resection of the epididymis for tuberculosis, he had several times been tempted to do it. His hesitation was caused by the fact that he could never positively exclude implication of the testis. In one case, where the gross appearance of the testis was apparently normal, he afterwards found three tubercular foci, which could not be detected by ordinary palpation. In cases where the disease has existed for a year or longer, foci will be found in the testis in the majority of the cases. The speaker said that he thought resection of the epididymis was justifiable only in very recent cases. The suggestion made by Dr. Meyer, to supplement the resection of the epididymis by an exploratory orchidotomy, was a valuable one, but even then small foci in the testis might easily escape detection.

DR. F. TILDEN BROWN said that, in one case of tubercular epididymitis in an early stage, he resorted to resection of the epididymis. The wound healed very promptly, but the man com-

plained of a feeling of discomfort in the testis; this gradually became more pronounced, and the testis was removed a year later. The discomfort in this case, Dr. Brown said, he thought was due to the fact that the testis was constantly being drawn up by the cremaster muscle and pinched in the ring.

DR. GEORGE WOOLSEY said he had had two cases where a secondary operation was necessary in order to remove the testis after resection of the epididymis. In one case the secondary operation was required within two or three months after the primary one.

DR. MEYER, in closing, said that in his case the patient has thus far not complained of pain or discomfort. This operation, of course, should be done as early as possible. As a rule, these patients with tuberculous epididymitis are allowed to go on for years, often until perforation into the testis had taken place. We know that in the majority of cases the disease commences in the epididymis, and if we operate early, a resection can be resorted to with some hope of success. As regards orchidotomy, only a single incision should be made. Conservative surgery is especially important in this region, on account of the mental symptoms which may follow removal of both testes.

TUMOR OF THE SHOULDER.

DR. JOHN F. ERDMANN presented a man, twenty-five years old, with an enlargement of the upper portion of the left arm and the corresponding shoulder, which had been first noticed over twelve years ago. The increase in size had been slow and gradual, sometimes ceasing entirely, for a term of years. There had been some increase during the past six months. The growth was irregular and nodular in outline, and hard, like bone, to the touch. There was no pain, excepting of a dull character, in the growth itself, but the patient complained of a sense of weight and pressure on that side of the chest. The functions of the arm were unimpaired. There was no history of traumatism. The man's family history was negative. Dr. Erdmann was in doubt as to the nature of the tumor-process.

DR. ELLSWORTH ELIOT, JR., said he thought the growth was certainly benign in character. The possibility, however, of its assuming a malignant type should not be lost sight of, espe-

cially in view of the fact that it had recently enlarged quite rapidly.

Dr. Eliot said he had seen several cases quite similar to this one, although not so extensive in character. In one instance which had come under his observation the patient had a growth in this vicinity, about the size of an orange, which apparently sprang from the epiphyseal line, and had gradually increased in size. The fact is pretty well recognized that these tumors, beginning originally at the epiphyseal line, are carried away from the line with the growth of the bone. Dr. Eliot said that in all of his cases, with one exception, there was no recurrence of the growth after operation. In all those cases there was no sacrifice of bone, nor was the usefulness of the arm impaired. The speaker recalled one case where a growth in a child, one year old, which resembled an ordinary exostosis springing from the lower epiphyseal line of the humerus, was kept under observation for several years, and, instead of increasing in size, it gradually diminished, and eventually was no larger than a small marble.

As regards treatment in the case shown by Dr. Erdmann, Dr. Eliot said that, in view of the fact that the growth had existed over ten years, it would hardly be justifiable to sacrifice the bone or do any operation which would interfere with the functions of the arm, unless a section taken from it revealed the presence of sarcomatous elements.

DR. WILLIAM B. COLEY referred to a somewhat similar case which was under Dr. Weir's care, at the New York Hospital, in 1889. In that instance the arm was amputated, as it was of very little use. The growth proved to be an enchondroma, without any sarcomatous elements.

In Dr. Erdmann's case, the speaker said, he thought it would be unwise to sacrifice the arm at this time.

DR. MEYER said the bone seemed to be much enlarged, and he regarded the growth as an enchondro-osteoma. The speaker referred to the case of a young lady, seventeen years old, who had a number of exostoses along the epiphyseal lines of different bones. One was situated near the shoulder, and annoyed her so much that she asked to have it removed. It was chiselled off without much difficulty, and its removal never interfered with the functions of the arm. In Dr. Erdmann's case, Dr. Meyer suggested leaving the growth alone, unless it gave rise to discomfort.

CARCINOMA OF THE FLOOR OF THE MOUTH
AND TONGUE.

DR. WILLIAM B. COLEY presented a man, forty-seven years old, with an epithelioma of very rapid growth, which was first noticed springing from the floor of the mouth about six months before. As there were no enlarged glands at that time, the growth was removed from above. Rapid recurrence took place, however, and five weeks ago Dr. Coley did a preliminary laryngotomy, at the same time tying the lingual arteries and taking out all the glands in the neck. Five days later he reopened the large V-shaped incision in the neck, made at the previous operation, separated the muscles from the jaw from below upward, and having entered the cavity of the mouth, the entire floor of the mouth and the anterior two-thirds of the tongue were brought through the opening and removed. The wound was then closed, with drainage. The tracheotomy-tube was left in ten days. Healing was satisfactory.

[At present, July 12, 1899, he has no evidence of recurrence.]

INDEX TO SURGICAL PROGRESS.

ABDOMEN.

I. Acute Peritoneal Effusion as a Symptom of Intestinal Strangulation. By PROFESSOR CARL BAYER (Prague). The author in 1898 (*Prager medicinische Wochenschrift*, Nos. 48, 49) called attention to the occurrence of acute peritoneal effusion in cases of internal strangulation, and the value of this symptom in the differential diagnosis between strangulation and peritonitis. At that time he reported a case in which he had depended upon this symptom, and operation had confirmed his diagnosis. The case proved one of intussusception. Some time previous to this Professor Bayer had noted that this effusion was present in cases of acute internal strangulation. On reviewing the literature of the subject he found that Heinrich Braun had called attention to this point in 1891 (*Verhandlungen der deutschen Gesellschaft für Chirurgie*, 1891, p. 376). Braun stated that the peritoneal effusion present was analogous to the fluid present in a hernial sac. He further stated that "the presence of fluid in the peritoneal cavity, which may reach such an enormous amount that it can be demonstrated by percussion, showed the presence of strangulation of the intestine in conjunction with other symptoms when ascites and peritonitis had been excluded."

Professor Bayer was gratified to find his views supported by these statements of Braun's, which, of course, he had not seen when his first article was published. There are two points, however, which Bayer wishes to emphasize. First, the symptom in question not only indicated strangulation after having excluded peritonitis, but is a valuable aid in the differential diagnosis between peritonitis and strangulation, and is direct proof of the

presence of the latter lesion. Peritonitis may be present and be increasing, and the initial dulness may be concealed by the increasing distention of the well-known paralytic character. Should, however, a rapid increase in dulness arise, becoming more marked hour by hour and clearly shown by percussion, it demonstrates the supervention of internal strangulation upon the existing peritonitis. If the case is a recent one, the large amount and rapid increase of the effusion renders the diagnosis one of strangulation. The second point to be emphasized is the importance of the acute nature of the effusion. This very acuteness is of aid in forming a diagnosis. A case of this kind is recorded by the author in the appendix of the report of the Barmherzigen Brüder Hospital, 1898. One of Professor Bayer's cases is presented in the present paper. The history is as follows:

A workman, eighteen years of age, suffering from peritonitis, was admitted to the care of Professor Bayer, April 1, 1899. He had been an inmate of the hospital in 1897. At that time he had an attack of perityphlitis. The course of the present trouble was subacute. There was slight dulness on the right side. All the symptoms gradually diminished. For some days the patient was free from fever, vomiting, and the other symptoms. His stools were normal, and he had begun to eat easily digested food. On April 18, after a rather restless night, he vomited and complained of pain. Examination revealed a new area of dulness upon the left side, extending to the edge of the rectus muscle. The upper portion of abdomen was distended and painful on slight pressure. Slight peristaltic movements were observed. A diagnosis of strangulation of the small intestine was made. Immediate laparotomy was performed. As soon as the peritoneal cavity was opened, a quantity of bloody serum escaped. It was found that the great omentum was divided into three cord-like processes, the right one of which was solidly adherent to the ileo-cæcal junction. This adhesion dated from the attack of perityphlitis, in 1897. This cord-like process was divided between two liga-

tures. The cæcum was filled with masses of fæces, but was not distended. The small intestine was collapsed for twenty-five centimetres from the ileo-cæcal junction, showing that the point of strangulation was higher up. The remaining portion of the small intestine was greatly distended. The constriction was found to be the middle one of the three processes of omentum, which was adherent to and surrounded the gut. This adhesion was recent, and could be bluntly though not easily dissected away. As soon as the constriction was relieved, the collapsed intestine became filled with intestinal contents from above. The third process of omentum was found adherent to the intestine higher up, and required separation. The entire greater omentum was removed with the exception of a small portion close to the transverse colon. The ileo-cæcal junction was found patent despite the cicatricial adhesion formed there. The patient made a complete and uneventful recovery. He has since had no trouble as regards the action of his bowels.

[This case is particularly well adapted to show the value of acute intra-abdominal effusion in differential diagnosis.]—*Centralblatt für Chirurgie*, 1899, Vol. xxiii, pp. 665-667.

II. The Purse-String Suture in the Closure of Wounds of the Peritoneum. By DR. F. DE QUERVAIN. The author advocates the use of the purse-string suture in the closure of the peritoneum in all laparotomy wounds of an area which will permit of its use. No one has defined the indications for the use of the purse-string suture. It has been used for diminishing the size of wound cavities, cysts, and by some for closing the neck of hernial sacs. The author gives the credit to Doyen for first advocating the use of this form of suture in abdominal surgery. [Doyen presented a paper before the Surgical Congress at Berlin in 1898 (*Centralblatt für Chirurgie*, 1898, p. 122), in which he discussed the applicability of this form of suture for burying the ligated stump of the appendix into the

cæcal wall and in bowel and stomach surgery. The previous year this surgeon had published a method of closure of the cul-de-sac of Douglas, after hysterectomy, by means of the purse-string suture (Doyen, "Surgical Technic," Paris, p. 581). It is hardly necessary to remark that Dawbarn is the originator of the purse-string method of treating the appendix.]

In using this means of closing the peritoneum it was the author's idea to restrict, as much as possible, the exposed wound area, so that there would exist less liability of the attachment of bowel or omentum to it.

From a careful study of the literature, the conclusion was reached that even under most careful asepsis the probability of the attachment of some of the abdominal viscera to the suture-line was great. Kelterborn (quoted by Uhlmann, *Archiv für Gynäkologie*, Band liv, p. 384) and Steffens (*Beiträge zur klinische Chirurgie*, Vol. xxiii, 2, 1899) assert that this adhesion to the suture line is the result of slight infection. Dembowsky (*Archiv für klinische Chirurgie*, Vol. xxxvii, p. 745) and Thomson (quoted by Uhlmann) point out that the use of silk for closing the peritoneum, by acting as a foreign body, favors the formation of adhesions. Superficial injuries to the peritoneal endothelium are mentioned by Bum, Nieberding, Stern, and Reichel. Such injuries may be the result of drying the peritoneum (Walthardt, *Korrespondenzblatt für schweizer Aerzte*, Vol. xxiii, p. 513).

The author agrees with all of the above. Previous to Walthardt's publication moist asepsis was used in Kocher's clinic. Attachments from this cause will occur only in those cases in which the abdominal contents have been long exposed.

Judging from the experience of numerous laparotomies, in which the formation of adhesions between the suture-line and the neighboring peritoneum and the adjacent bowel or omentum occurred, we may conclude that, however great a causative relation the presence of a minor degree of infection or the drying of the peritoneum may bear to this, the mechanical injury and the

presence of the suture-material as a foreign body play a still more active part. It will be of extreme value then, as a safeguard against the occurrence of adhesions, to restrict, as much as possible, the peritoneal surface so predisposed. This may be satisfactorily accomplished by means of the purse-string suture.

The main objection to the method is that a funnel might be formed which would predispose to hernia. This is met by the author by the statement that abdominal hernia is either caused by defective union of the fascia and muscle or is due to paralysis of the latter from injury to the nerve-supply. In addition, the elasticity of the peritoneum counteracts the formation of a funnel.

Quervain applied the purse-string suture and the Lembert continuous suture to different parts of the bowel, in fresh *cadavera*, ligating the bowel at one point and attaching a manometer at another. The various sutures were applied after incision of the convex surface of the gut. It was found that the purse-string was by far the stronger, being capable of standing from two to three times the amount of pressure sustained by the Lembert suture. Sections of bowel with the sutures in place were inverted and the experiments continued. These tests also proved the superior strength of the purse-string suture.

The author defines two forms of the purse-string suture, one used for turning the serous surfaces inward, as in closing the bowel, gall-bladder, or urinary bladder, the other used in closing the peritoneum in laparotomies. For the latter purpose it is necessary that the peritoneal opening does not exceed eight or ten centimetres, and that a certain degree of mobility of the peritoneum should exist, such as is found in the epigastric region of an emaciated patient. Quervain has used this method in operations upon the adnexa, in appendicectomy in the interval, and in exploratory laparotomy.

The method, as illustrated by the author in cases of appendicectomy in the interval, consists in making a four centimetre incision in the peritoneum, through which the finger determines

whether the opening is sufficient for the exposition of the appendix. If not, the opening is stretched by means of the fingers to a sufficient size and four clamps applied to the stretched edges. Following the completion of the appendicectomy, the application of the purse-string suture is begun. For this purpose Doyen's needle, of a medium curve, is used. Here, as in all cases in which the peritoneum is turned in, as in bowel operations, it is important that as little as possible of the suture material should be exposed on the peritoneal surface. When the suture has been placed, the ends are slowly pulled upon until the opening is closed, then the first half of the knot is tied, and enough traction put upon the suture to insure accurate and complete closure of the opening without danger of necrosis. The final half of the knot is tied and the remaining layers of the abdominal wall are closed in the usual manner.

RUSSELL FOWLER (New York).

CHEST.

I. Gunshot Wounds of the Pericardium. By DR. EICHEL. The author states that gunshot wounds of the pericardium may occur without injury to the heart-muscle. This can only be determined definitely post-mortem or during the course of an operation. Under the special heading, "Cases with Probable Injury to the Pericardium," Eichel has placed those cases in which direct proof is lacking. The clinical considerations are preceded by an accurate description of the anatomy of the pericardium and pleura.

Illustrations taken from Merkel's and Fanja's text-books show how much the anatomy of the parts vary, particularly the insertion of the pleura to the costal cartilages and sternum. The cardinal point in operating upon the pericardium is the prevention of any injury to the pleura with its disagreeable consequences. According to Waldeyer, whose views on this subject are generally accepted, it is almost impossible to puncture the

pericardium through the soft parts of the anterior chest walls without injuring the pleura. In order to absolutely avoid injury to the pleura in paracentesis of the pericardium, it is necessary to either trephine the lower part of the body of the sternum upon the left side or to resect the sixth and seventh costal cartilages. In the presence of effusions or other inflammatory processes, which bring about changes in the relation of the parts, the situation is different.

Particular attention must be given the possibility of injury to the pleura and lung. Substitution of the area of cardiac dullness by a corresponding area of tympanitic note is one of the essential symptoms. For the most part the symptoms do not differ from those of pericardial inflammations and effusions in general.

Treatment is expectant. Should the heart's action be seriously interfered with by the effusion, or should there be a suspicion that there is not drainage in case of pus, pericardiotomy is indicated. Contrary to Rehn and Schaposchnikoff, the author did not observe that the heart was swimming on the surface of the pericardial pus, but rather that a layer of fluid obscured the heart.—*Archiv für klinische Chirurgie*, Band lix, Heft 1.

II. Surgical Treatment of Suppurative Pericarditis.

By C. A. LJUNGGREN. This paper reports a case of suppurative pericarditis, treated by incision and drainage, which terminated in recovery. The results of the operation, as practised heretofore, are discussed, also the different methods of opening the pericardium, and the after-treatment. Puncturing the pericardium is an operation the reliability of which may be questioned, and which seems to the author a decidedly dangerous procedure. Incision and drainage, on the other hand, is more rational from the pathologico-anatomic stand-point, and is followed by a greater number of recoveries. The author has added six cases to the thirty-five collected by Roberts (*American Journal*, 1897). Of these sixteen

recovered and twenty-five died. Of these sixteen recoveries eight cases were complicated by other diseases. In seven of the fatal cases death was due either to faulty technique or to the length of time spent in operating. Ljunggren has formulated the following rules to govern operations for suppurative pericarditis:

(1) The pericardium must be opened sufficiently to permit of a complete view of its contents, thorough drainage by means of two thick drainage-tubes, and the easy removal of the fibrinous masses present.

(2) The incision must be so placed as to afford thorough evacuation of pus, and permit drainage of the posterior portion of the pericardium without interfering with the movements of the heart.

(3) The incision is to be so placed as to lie within the normal boundaries when the pericardium has retracted.

(4) The pleural cavity must be protected against infection by the pericardial pus.

(5) In order not to injure the lung the incision must be altogether within the area of absolute dulness.

(6) Should it be impossible to avoid the mammary vessels, it is best to ligate before cutting them.

(7) In opening the pericardium carefully avoid any injury to the heart.

(8) The operation must be made as short and simple as possible. General anæsthesia is contraindicated in weak patients.

By resecting a portion of the fifth rib in the left mammary line we comply as closely as may be to the above demands. In some cases resection of the sternal end of the sixth costal cartilage will be of aid. The pleura is bluntly loosened and sutured laterally to prevent infection of the pleural cavity.

The author agrees with Roberts that, irrespective of the cause, operation should be performed as soon as the diagnosis is established.—*Nord. med. Ark., New Series*, 1899, Vol. ix, No. 28.

DIFFERENTIATION OF THE URINES.¹

By F. TILDEN BROWN, M.D.,

OF NEW YORK,

ASSISTANT SURGEON TO THE PRESBYTERIAN HOSPITAL.

ALTHOUGH the methods and devices for accomplishing some harmless, reliable, and painless way to collect urine directly from the ureters have alternated in advancing and receding waves during the past quarter of a century, still the retrospect shows a steady tidal progression, until at the present date the practice is an assured success in the great majority of cases; and we believe it is not fallacious to predict that the near future will see improvements in instruments and technique which will render now difficult cases easy, and the few impossible cases of ureter catheterization possible. Not that any one device is to meet all requirements, any more than one catheter will serve equally well for all bladders. Excellent as are the instruments of to-day, they are all susceptible of improvement.

As soon as surgery found that many diseased states of the kidneys came within its province, its votaries, and medical men in general, showed an awakened interest regarding first the existence of a second kidney, then as to the gross conditions of these organs, and, finally, they tried by more exact methods to discover the minute chemical differences in the secretions of the two glands, and the varying functional capacities of each.

¹ Because in the cases to be reported the "segregator" of Dr. Harris was employed several times in conjunction with ureter catheterization, a title has been sought for the paper applicable alike to both tests.

Read before the New York Surgical Society, May 10, 1899.

The experiences of many could verify the statement that an unsuspected occlusion of one ureter has at times spoiled a diagnosis because a negative report as to the existence of any renal disorder was returned after normal urine from the other kidney had been carefully examined; and it has long been recognized that faulty urine passed voluntarily through the urethra afforded by its analysis very little scope for adequate specialization in locating a lesion; representing as such urine did the secretion of two kidneys, plus the detritus, and pos-

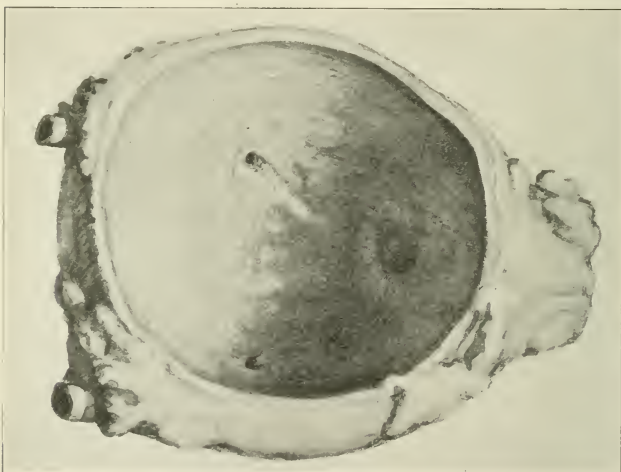


FIG. 1 —Horizontal trigonum; ureters easy to catheterize.

sible pathological elements of two ureters, a bladder, and urethra.

It seemed an easy matter to exclude the urethra from complicating the problem, and to reach truth-telling mixed urine in the bladder by slipping a sterilized catheter into this viscus; but when the fact was realized that lesions of the posterior urethra shed their products into the bladder, it was seen that urethroscopy, or the Goldenberg-Jedassohn test, must first assure one of a healthy posterior urethra before the evidence of

urine at this forward common station could be trusted, and even then only complications of the lower fourth of the urinary tract had been eliminated, because the bladder and two diverging ureters and kidneys remained to be reckoned with.

In connection with differentiation of the urines, the anatomical structure known as the trigonum may with propriety be given a physiological importance, and called the urinary triangle, at the anatomical apex of which the mingled fluids of the two kidneys represent the common output, and where each

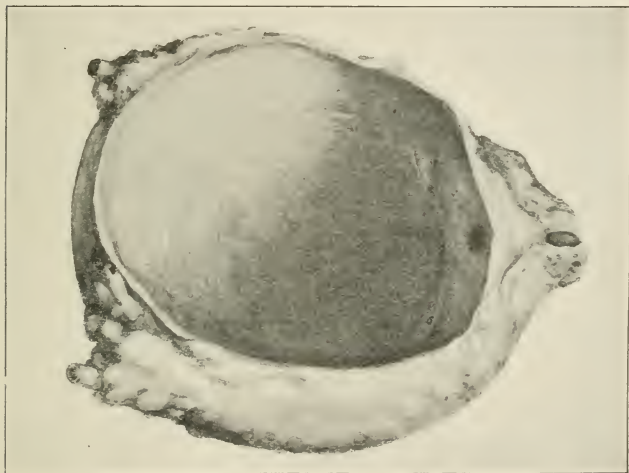


FIG. 2.—Vertical trigonum; ureters more difficult to catheterize.

of the basal angles represents—when urine is gathered within their ureter-mouths—individual renal secretions. When an adequate quantity of urine has been collected at each of these three isolated stations, and a competent chemical, microscopical, and bacteriological examination made of each specimen, specific data are possessed, by the mutual contrast of which we are afforded an insight to the conditions affecting these divisions of the urinary tract; and for reasons somewhat akin to those associated with a practice in geographical survey, the method may

be alluded to as a test by urinary triangulation. Because the civil engineer may fail to learn the existence of a substratum of quicksand, and thereby some intended enterprise suffer delay and unexpected expense, the economic value of his profession is not questioned: the same must be conceded to the gatherer of separate urines when occasional fallacies occur, such as failure to detect the presence of a yet unruptured tuberculous or calculous lesion in the parenchyma of a kidney.

When Thornton advocated laparotomy as the preliminary step in all nephrectomies, whether the removal was finally an

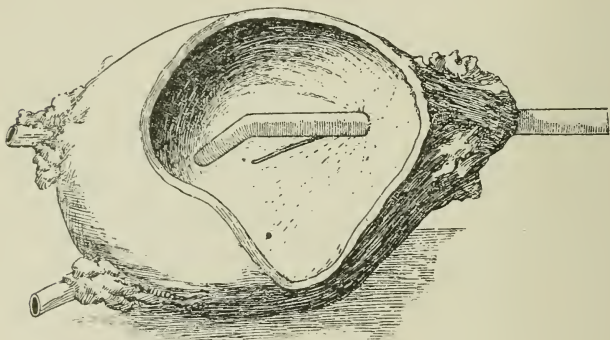


FIG. 3 (A).—Flat trigonum and low vesical sphincter, easy to enter the ureter by either style of catheter cystoscope.

intra- or extraperitoneal one, for the reason that it permitted the operator to palpate the opposite gland, his proposal clearly indicated the determination of able surgeons not again to expose their patients and themselves to a predicament which had startled a few operators,—viz, the removal of the only kidney; as well as the hope to avoid a risk which had embarrassed more,—the removal of the better of the two organs.

Not only was this route of Thornton's illy adapted for many nephrectomies which were completed as intraperitoneal operations,—mainly because the exploration was so begun,—

but the latter itself afforded a chance to learn little more than the presence of a second kidney. The suggestion was of material value, however, as an additional stimulus to discover a better means of estimating the existence and comparative worth of the two organs.

Although not in chronological order, the following practices of eminent men go far to show their estimate of the acquisition of preoperative facts regarding each of the kidneys, and will serve to refute the criticisms of such recent writers as Israel, Holländer, Mackenrodt, Edebohls, and others, who for some reason appear anxious to belittle the value of urinary differentiation.

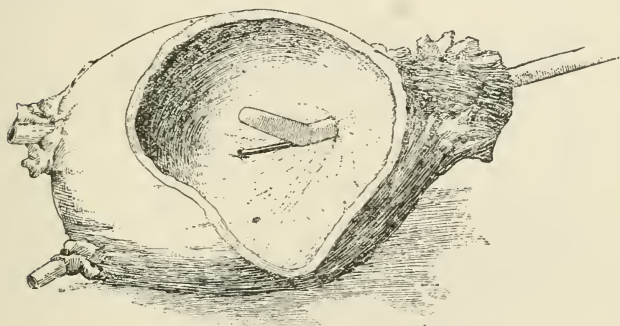


FIG. 4 (B).—Flat trigonum and low vesical sphincter, easy to enter the ureter by either style of catheter cystoscope.

Harrison, Iversen, and Guion advocated epicystotomy (*Lancet*, February, 1884), to permit the introduction of catheters into the ureters of males.

Bozemann and Emmett performed colpocystotomy to effect the same purpose in women.

Hegar and Sängner applied a temporary ligature about one ureter while the opposite emptied the urine into the bladder.

Others sought to avoid a cutting operation, and to accomplish in males the collection of separate urines as successfully as Simon had for some time been doing in females.

Tuchmann pinched up the vesical coats where they encompassed the ureter with an instrument resembling a lithotrite, and collected the urine from the other ureter as it gathered in the bladder.

Eberman employed a ureter-clamp, one arm of which rested in the bladder, the other in the rectum.

Weir sought with a modification of Davy's rectal lever to compress and occlude one ureter against the ilio-pectineal line.

Sands aimed at doing the same with the finger in the rectum.

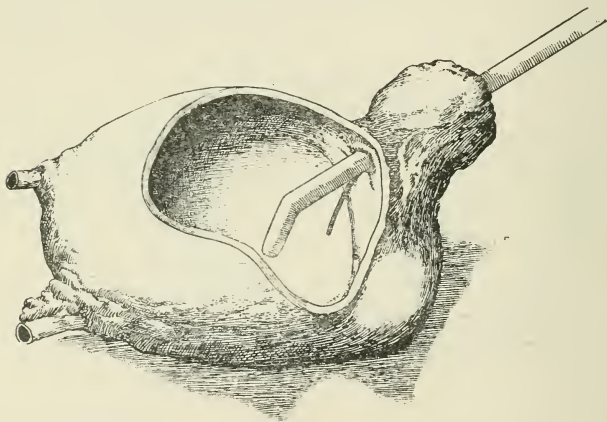


FIG. 5 (A).—Very precipitous trigonum; fruitless effort to enter the ureter with either style of catheter cystoscope.

Silbermann used a catheter with a balloon-like end, which, when in the bladder, was filled with quicksilver and brought over one ureteral opening.

Polk introduced a metal catheter, against which one ureter was to be occluded by digital pressure in the rectum.

Müller¹ tried compression of the ureter in the same way, only substituting a balloon for the finger.

¹ For a more detailed description of most of these devices, see "Ueber Künstlichen Zeitweiligen Harnseilerirrschluss," *Deutsche medicinische Wochenschrift*, 1887, No. 31, p. 689, by P. Müller.

Fenwick¹ presented a device for suction of the ureter. This was a metal catheter with a very long eye on one side of the beak, into which the ureter-mouth was to be aspirated, and thus held in position by the suction of a rubber ball while it delivered ten minutes' flow of urine. He said of this apparatus, "It is easy of application, but not infallible," and commented upon the devices of others in these words: "The labor expended upon the question is as yet unproductive, for the

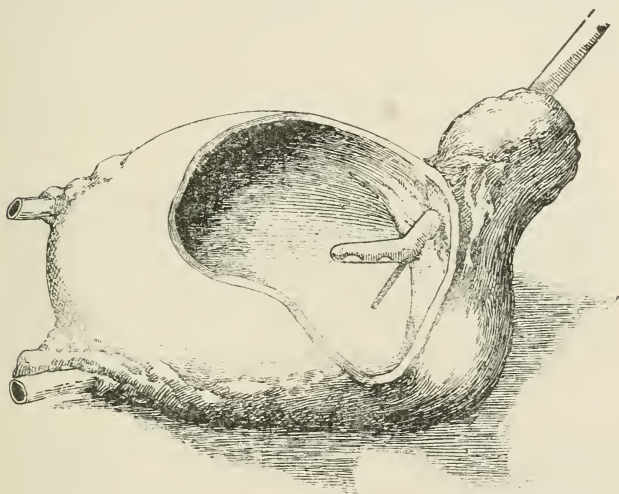


FIG. 6 (B).—Very precipitous trigonum; impracticable to enter the ureter with any style of catheter cystoscope.

instruments, operations, and suggestions of Tuchmann, Silbermann, Eberman, Weir, Sands, Glück, Harrison, and others, are lacking, some in simplicity, some in safety, most in success."

Now to review the catheterization of the ureters in women without a cutting operation.

As early as 1875 Gustave Simon had accomplished it by

¹ *Lancet*, London, September 18, 1886, p. 529.

introducing large urethral dilators preliminary to inserting the forefinger, and under its tactile guidance he passed a stiff metal catheter into the ureter. This success was recorded fifteen times in seventeen trials. Of course, general anæsthesia was requisite, and under the circumstances some little bleeding must have occurred in or at the ureter.

Pawlick then practised this same method, but later substituted for extreme urethral dilatation and the guiding finger a urethral tube, to expose the ureteral opening to vision by direct or reflected illumination, and by it the insertion of a metal catheter was effected.

David Newmann, Hirsh, Hamill, Howard Kelly, and Goldschmidt pursued the same successful practice in female cases.

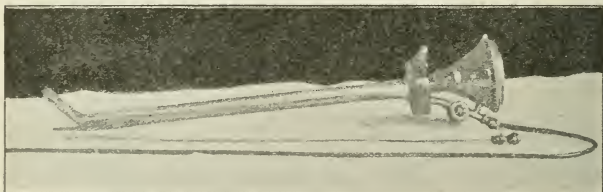


FIG. 7.—Dr. Brenner's ureter cystoscope (1889).

Howard Kelly, besides doing more to popularize this procedure than any one else, has demonstrated the possibility of even applying the method in some male cases. Long before he had done this, however, several had made alterations in the electric lighted Nitze-Leiter cystoscope, to provide this instrument with a separate channel for the conveyance of a flexible gum-silk ureter catheter, with the belief that such a contrivance could be as successfully used in men as in women. And it now seems probable that from this principle will evolve the perfect instruments of the future.

The first instrument of this class was that of Dr. Brenner (1887), and Boisseau du Rocher's shortly after.

They utilized the Nitze-Leiter cystoscope, which had its window opposite the eye-piece, and a catheter outlet just below the window.

Brenner did not realize his expectations, and, after a brief trial, made public his disappointment; Zuckerkandl reports that Brenner shortly afterwards left Vienna. Until seeing this statement recently we had wondered why the inventor failed to persevere with and discover the merits of his own device.

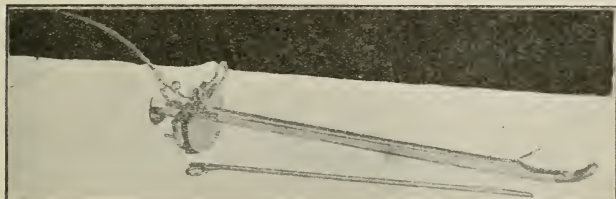


FIG. 8.—Dr. Caspar's later cystoscope (1898).

The late Dr. James Brown, of Johns Hopkins University, was the first person to prove the utility of Brenner's instrument in both sexes, and in the *Bulletin* of that institution for September, 1893, reported three cases.

Had he lived, we have little doubt he would have saved Dr. Brenner's valuable instrument from falling into the undeserved oblivion it has so long suffered.

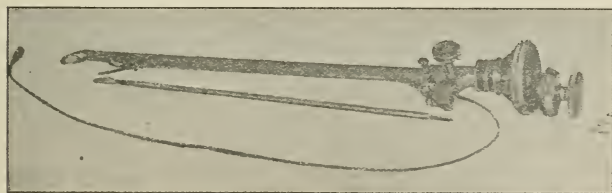


FIG. 9.—Dr. Nitze's ureter cystoscope (1898).

Nitze thought the failure of Brenner's attempt would be redeemed by utilizing for ureter work the cystoscope which had its window in the concavity. Consequently in 1894 he produced a modification, having two novel points, the better of which resulted in giving a small observation cystoscope

when removed from the catheter-carrier; but for its intended purpose the composite instrument was illy adapted.

Caspar, on the other hand, caught the inspiration of the requirements for ureter catheterization, and at the same time with Nitze brought out a valuable instrument, despite the fact that one of its two novelties was not sufficiently attained, —namely, control of the curve of the intravesical end of the catheter.

Albarran then followed with an instrument possessing some decided advantages, especially in the wide range of intravesical catheter control. This he secured, however, at the expense of an uneven and harmful protrusion on the shaft where the catheter issued.

Nitze then adopted this device of Albarran's, but sheathed

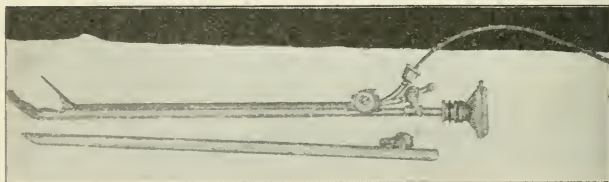


FIG. 10.—Dr. Albarran's instrument showing catheter tilted by the lever; also an interchangeable cover-piece to be used for irrigation.

the objectionable, rough, lever-controller during insertion in the shaft, and produced an appealing but complicated mechanism, which for practical use has been disappointing to us. He has again modified this last instrument, and done away with the dangerous travelling catheter canal.

Caspar again presents a new instrument, which improves upon its best original features and alters others, some of which had been less desirable. Now it is a still more beautiful, safe, and practical ureter cystoscope.

Even this brief paper on urine collection will not be properly offered without reference to the latest device, where we see a reversion to the more primitive type, a characteristic in the evolution of everything, and no exception is found in this

search for a simple yet perfect method for collecting separate urines. We refer to Dr. Harris's urine segregator, a device where provision is most ingeniously made for tapping right and left urines at the same time as they are voided by their respective ureters into the bladder. From our experience thus far we would never advocate the employment of the urine segregator where ureter catheterization was equally feasible;

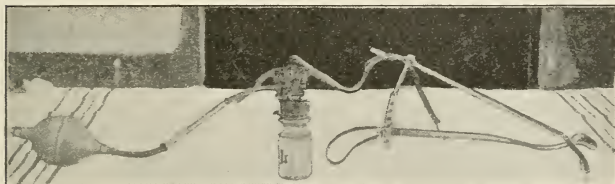


FIG. 11.—Dr. Harris's segregator.

when the latter, however, cannot well be done, or done at all, the Harris instrument, if applicable, is a resource of value.¹

It must help us to establish urinary differentiation upon the basis belonging to it, and go far towards proving that in every case of anticipated nephrectomy at least such a test is due to the patient, if we give here a brief *résumé* of the published cases² of Pawlick, Caspar, James Brown, Meyer, Albarran, Kelly, Zuckerkandl, Imbert, Rubeska, von Federooff, Schoemaker, Hirst, and Harris, as well as our own.

PAWLICK: Nine cases,—all females.

- (1) *Renal Colic*: Catheterization revealed the nature of the obstruction and the condition disappeared.
- (2) *Stricture of the Ureter*: Demonstrated by catheterization; tentative dilatation; nephrectomy.
- (3) *Movable Right Kidney*: Catheterization showed the left kidney diseased; no intervention.

¹ Our as yet unpublished discussion on the occasion of Dr. Harris's paper.

² For the details of these cases, see "Le Cathétérisme des Uretères par les voies naturelles," by Le Dr. Léon Imbert, Paris, 1898, and "Handbuch der Cystoskopie," von Dr. Leopold Caspar, Leipzig, 1898.

- (4) *Calculous Pyelonephritis*: Demonstrated by catheterization; left kidney healthy; nephrectomy; cure.
- (5) *Catheterization controverted a Diagnosis of Tumor of the Kidney*: Operation showed the tumor to be ovarian.
- (6) *Hydronephrosis*: Evacuated by catheterization.
- (7) *Right Pyelonephritis*: Demonstrated by catheterization.
- (8) *Tumor of the Right Kidney*: Diagnosis confirmed by catheterization; it also proved the opposite kidney healthy; nephrectomy.
- (9) *Sarcoma of the Left Kidney*: Catheterization showed the right kidney healthy; nephrectomy; death.

CASPAR: Fifteen cases,—eight males; seven females.

- (1) *Cystitis and Pyelitis*: Cured by ureteral catheterization and lavage.
- (2) *Catheterization* showed the absence of pyelitis.
- (3) *Left Renal Lithiasis*: Suspicion confirmed by catheterization.
- (4) *Right Renal and Vesical Tuberculosis*: Confirmed by catheterization.
- (5) *Left Pyonephrosis* (nephrectomy): Catheterization showed the opposite kidney diseased.
- (6) *Right Pyonephrosis*: Operation dismissed.
- (7) *Right Calculous Pyonephrosis*: Catheterization showed a left pyonephrosis also; nephrotomy; death.
- (8) *Right Kidney Tuberculous*: Catheterization showed the left in satisfactory condition; nephrectomy; recovery.
- (9) *Left Renal Lithiasis; Anuria*: Catheterization demonstrated an obstruction in left ureter; cure.
- (10) *Right Calculous Pyelonephritis*: Catheterization demonstrated an obstruction in the ureter.
- (11) *Wound of the Ureter Inflicted during Hysterectomy*: Condition demonstrated by catheterization.
- (12) *Wound of the Ureter during Laparotomy*: Demonstrated by catheterization.
- (13) *Gonorrhœal Pyelitis*: Ureter catheterization and lavage; cure.
- (14) *Cancer of the Kidney*: Diagnosis confirmed by catheterization.
- (15) *Renal Calculus*: Recognized by catheterization.

JAMES BROWN: Three cases,—two males; one female.

- (1) *Pyelonephritis and Lithiasis*: Demonstrated by catheterization.

(2) *Left Calculous Pyelonephritis*: Catheterization showed the right kidney diseased; no operation.

(3) *Pyelonephritis*: Demonstrated by catheterization.

MEYER: Eight cases,—seven males; one female.

(1) *Left Renal Calculus*: Catheterization strongly supported the diagnosis made from the clinical history.

(2) *Left Chronic Nephritis and Pyelitis*: Demonstrated by catheterization, which also showed the right kidney normal.

(3) *Right Renal Calculus*: Clinical suspicion was supported by catheterization.

(4) *Left Chronic Nephritis with Pyelitis* (probable etiology calculus): Diagnosis made through catheterization.

(5) *Pyelitis of the Right Kidney* (moderate): Diagnosis made through catheterization.

(6) *Right Renal Tuberculosis*: Diagnosis made by catheterization.

(7) *Right Pyelonephritis*: Diagnosed by catheterization,—probable etiology calculus.

(8) *Right Renal Tuberculosis* (left kidney healthy): Diagnosis made by catheterization; right nephrectomy; recovery.

ALBARRAN: Seventeen cases,—five males; twelve females.

(1) *Hæmaturia*: Catheterization showed the suspected kidney to be healthy.

(2) *Hydronephrosis*: Diagnosticated clinically; but this error was recognized before operation by ureter catheterization.

(3) *Movable Kidney*: Trifling renal retention demonstrated by catheterization.

(4) *Hydronephrosis and Movable Kidney*: Catheterization yielded a clear urine.

(5) *Calculus of the Right Kidney*: Diagnosticated by catheterization.

(6) *Renal Colic*: Catheterization of ureter; cessation of pains.

(7) *Cancer suspected in Right Kidney*: Catheterization demonstrated retention of blood stained urine in the left kidney.

(8) *Tuberculous Pyonephrosis and Cancer of the Right Kidney*: Catheterization confirmed the diagnosis of pyonephrosis.

(9) *Pyonephrosis*: Obstruction of the ureter recognized by catheterization.

(10) *Movable Kidney*: Stricture of the ureter.

- (11) *Calculous Pyonephrosis*: Catheterization showed presence of an obstruction; nephrectomy; death.
- (12) *Calculous Pyonephrosis*: Catheterization.
- (13) *Pyonephrosis* (nephrotomy): Catheterization favored the rapid closure of a fistula.
- (14) *Pyonephrosis* closed without a fistula by nephrotomy and a ureter catheter passed from above.
- (15) *Renal fistula* treated by catheterization of the ureter.
- (16) *Supernumerary Ureter entering in the Vagina*: Transplantation to the bladder.
- (17) *Double ureter* of the right side demonstrated by catheterization.

KELLY: Seven cases,—all females.

- (1) *Renal calculus* recognized by catheterization.
- (2) *Calculus* recognized by ureter catheterization.
- (3) *Calculus* recognized by ureter catheterization.
- (4) *Pyelonephritis and stricture* cured by ureter catheterization.
- (5) *Pyelonephritis* cured by ureter catheterization.
- (6) *Renal calculus* recognized by catheterization.
- (7) Ureter catheterized as a preoperative safe-guard in vaginal hysterectomy.

ZUCKERKANDL: Two cases,—two males.

- (1) *Right Pyonephrosis*: Demonstrated by catheterization; nephrotomy.
- (2) Catheterization yielded pus and many atypical epithelial cells from left side, affording strong suspicion of renal neoplasm.

IMBERT: Two cases,—one male; one female.

- (1) *Hydronephrosis*: Cured by ureter catheterization.
- (2) *Hydatid Cyst of the Liver mistaken for Hydronephrosis*: Ureter catheterization showed the kidney not diseased.

RUBESKA: One case,—female.

- (1) *Pyuria*: Catheterization showed right pyelonephritis and a normal left kidney.

VON FEDEROFF: One case,—male.

- (1) *Hydronephrosis*: Catheterization demonstrated ureteral obstruction.

SCHOEMAKER: One case,—female.

- (1) *Hydronephrosis*: Dilatation of the ureteral obstruction followed by great improvement.

HIRST: One case,—female.

- (1) *Bilateral Pyelonephritis but of Unequal Severity*: Demonstrated by catheterization.

In reviewing the histories of these cases it will be seen that the five cardinal points claimed for ureter catheterization have been verified,—viz., it answers or helps to answer such questions as—

(1) A patient presents a variety of disturbances. Do they or do they not involve a urinary lesion?

(2) A patient presents the symptoms of a urinary lesion. Does this affect the superior urinary tract or the inferior?

(3) The patient is affected with a renal lesion. Which kidney is affected?

(4) One kidney is diseased. What is the condition of the other?

(5) One kidney is diseased. What is the nature of the lesion?

The possibility of making the following renal diagnoses by ureter catheterization is very reasonably claimed: Renal lithiasis; pyelitis; pyelonephritis; pyonephrosis; hydronephrosis; cases of movable kidney; tumors of the kidney. In lesions of the ureters: To detect obstruction and spasm; wounds or surgical division of its coats; lodged calculus; anomalies of the ureters.

Therapeutic value is claimed for ureter catheterization: As a preliminary means of safe-guard in operations on the pelvic organs, especially women; to enable healing solutions to be applied to the pelvis and calyces of the kidney; for the cure of renal fistulæ; for the relief of painful cystitis.

Besides our pleasure in offering a series of cases to substantiate the diagnostic value of urinary separation, it is the purpose of our paper to call attention to the merits of Dr. Brenner's ureter cystoscope, with which most of the cases were examined.

Before this paper was half finished we saw, with regret, that Dr. Sondern's full analysis of most of these patients' urines could not be included on account of prescribed space. By their

full publication in another article we hope to emphasize the clinical importance of urinary differentiation. Whereas this paper had its main object in a demonstration of the average feasibility of correct instrumental collection of the urines without the employment of general anæsthesia and without detriment to the patient, we wish, nevertheless, here to express the conviction that any value accruing from our part of the work would without Dr. Sondern's analyses and his personal conclusions attached to each of the reports have been greatly lessened.

With slight exception, all writers and workers in the field of ureter cystoscopy have not only endorsed Brenner's admission that his own instrument was practically useless in catheterizing male cases, but for work in either sex they have condemned the principle upon which it was conceived,—viz., his attempt to utilize the convexity of a cystoscope for the intravesical outlet of the catheter.

As stated above, Dr. James Brown, of Baltimore, was the first to controvert this by publishing the two cases in males where he used a Brenner instrument successfully, and one female case.

No other advocate appeared until 1898, when Zuckerkandl¹ said, "I thought it proper, in the interest of the subject, to point out that Brenner's cystoscope, which for years has been of great utility in females, answers also all the demands of ureteral catheterization in men," and cites two cases.

Casper² makes the following comment upon Zuckerkandl's remark: "Such may be the case now and then; but in the majority of instances one would encounter insurmountable obstacles."

Our experience thus far leads to the conclusion that cases presenting for ureter catheterization, or for any of the methods of collecting the separate urines, may be grouped in four classes:

¹ Ueber die Verwendung des Brennerschen Kystoskopes zur Sondirung der Harnleiter am Manne, Wiener klinische Wochenschrift, 1897, p. 375.

² Handbuch der Cystoskopie, Leipzig, 1898, p. 141.

- (1) Those favorable for the success of such collection.
- (2) Unfavorable cases.
- (3) Difficult cases.
- (4) Impossible cases.

As is readily seen, a great variety of abnormal conditions may pertain in individual cases in these different classes to render catheterization tedious or impossible.

In the favorable cases the separate urines are about as easily secured by one method or instrument as by some other.

In the unfavorable cases there is considerable scope for judgment as to what method or what individual cystoscope to employ.

In the difficult cases the importance of such a selection becomes more manifest, and a preliminary examination may well be provided for to antedate by several days the attempt to collect the urines.

In the impossible cases,—and these form a striking minority,—practically those conditions would present which interdict even the use of the simple observation cystoscope.

In the following record of cases, which have been subjected to catheterization of the ureters, the patients examined for others are indicated by the name of the latter. The subsequent history of a number of these cases is not known.

The cases designated personal are essentially our own.

Those having the donor's name, as well as the word "personal," indicate such as were presented for both examination and subsequent treatment. And we wish here to express our deep appreciation of the kindness of the many who have favored us with much of this interesting material.

REPORT OF CASES OF URETER CATHETERIZATION DONE BY THE AUTHOR.

CASE I.—Dr. W. S. Seamans and personal. D., male. Slight albuminuria. Unable to pass physical examination for business association. Physician and patient hoped albuminuria had its origin in vesical catarrh. Catheterization of ureters showed same albuminous urine from left kidney, a very slight pyelitis with a growth of *bacillus coli communis*. (Caspar.)

CASE II.—Dr. E. L. Trudeau. G., female. Painful crises, involving left kidney region. Suspected left renal tuberculosis. Microscopic examination of urine drawn from left ureter did not confirm it. Inoculation test of this woman's urine was not made. (Brenner.)

CASE III.—Dr. A. J. McCosh and personal. M. H., female. Two years before, right nephrectomy for tuberculosis. Left ureter now catheterized showed normal urine. (Brenner.)

CASE IV.—Personal. B., female. Movable left kidney. Catheterization showed slight pyuria. Nephropexy. (Brenner.)

CASE V.—Personal. D., female. Entered hospital with symptoms and history of septic endometritis merged into a condition of pernicious anæmia. Enlarged right kidney discovered later. Catheterization gave no urine from right ureter. Nephrectomy. Large white kidney. Pneumonia; death. Remaining kidney normal. (Brenner.)

CASE VI.—Personal. F., female. Five months before we removed a reported malignant papilloma of bladder; pedicle close to right ureter. Ureter catheterization now showed normal urine from that side. (Brenner.)

• CASE VII.—Personal. V. B., male. Sent into hospital with reported genito-urinary tuberculosis. Catheterization of ureters showed normal urine. (Brenner.)

CASE VIII.—Dr. S. W. Schapira. J. M., male. Suspected right renal calculus. Catheterization supported the clinical history. No operation. (Brenner.)

CASE IX.—Personal. E., male. Bacteriuria and cystitis. Catheterization showed suspected kidney not affected. (Brenner.)

CASE X.—Personal. H. G., female. Movable right kidney. Catheterization showed urine practically normal; that from right kidney trifle better than from the left in amount of urea. Cultures; no growths; nephropexy. (Brenner.)

CASE XI.—Personal. L., female. Movable right kidney. Catheterization showed urines nearly the same. Very few leucocytes in right urine. Cultures; no growths; nephropexy. (Brenner.)

CASE XII.—Personal. H., male. Suspected left renal calculus. Catheterization gave urines nearly same, except in left urine there was a trace of indican and slightly less urea. Cultures from both gave no

growth. Nephrotomy. Uric acid stone wedged in pelvis and in one calyx. Shock. Death in two days. (Brenner.)

CASE XIII.—Dr. G. A. Tuttle and personal. E. J., male. Genital tuberculosis,—epididymis, vas, and seminal vesicle. Catheterization showed no disease in either kidney. (Brenner.)

CASE XIV.—Dr. E. Eliot, Jr. T., female. Six years ago right ovarian tumor removed. Seven weeks before admission to hospital gave symptoms of cystitis. Abdominal and lumbar pain; *thamuria*. Some tenderness all over abdomen. Most marked in right iliac fossa. Right ovarian region tender by vagina. Catheterization showed no right kidney lesion. (Brenner.)

CASE XV.—Personal. R. McG., female. Tuberculosis of ankle and one finger. Tenderness over right kidney and suspected enlargement of the same. Catheterization gave normal urine and no tubercle bacilli. (Brenner.)

CASE XVI.—Dr. W. Gilman Thompson. F. S., female. Family history of tuberculosis. Seven months ago suffered with heavy feeling in back and scalding micturition. Two weeks later considerable blood in urine. With slight variations, this state has continued up to date. Feverish at night; loss of ten pounds; hands and feet occasionally puffy. No reaction to three milligrammes of tuberculin. Catheterization of ureters gave blood-stained urine from the right; normal from left. Much albumen and many casts in right; none in left. Evident chronic nephritis on right. Etiological factor not ascertained. *Hæmaturia* shortly ceased, and patient left hospital. She writes she is still well, six months later. (Brenner.)

CASE XVII.—Dr. Andrew J. McCosh. B., male. *Pyuria*. Many perineal abscesses secondary to stricture of urethra. Extensive perineal and urethral operations. Unable to pass cystoscope. (Brenner.)

CASE XVIII.—Dr. C. A. Herter and personal. P. A. Symptoms suggest calculus lodged in ureter. Find tubercle bacilli in urine. Catheterization showed left kidney tuberculous. Right kidney normal. Nephrectomy; recovery. (Brenner.)

CASE XIX.—Dr. W. W. Smith and personal. K. W., female. Dr. S. found tubercle bacilli in urine. Catheterization showed right kidney tuberculous. Left kidney normal. Nephrectomy; recovery. (Brenner.)

CASE XX.—Dr. McCosh and personal. L., female. Right renal fistula, following nephrotomy; first attempt at catheterization; stricture of urethra prevented introduction of cystoscope; urethrotomy. Second attempt: Bleeding and incontinence of intravesical fluid made the attempt a failure. Suprapubic cystotomy; introduction of urethral catheter; collection of urine not satisfactory. Would have been better to have utilized the general anæsthesia for ureter catheterization by the cystoscope instead of devoting it to suprapubic cystotomy catheterization. (Brenner.)

CASE XXI.—Dr. C. T. Parker. X. Y., male. Tender tumor in region of left kidney; severe hæmaturia; frequent excruciating vesical spasms. Observation cystoscope passed revealed nothing because of blood. Suprapubic cystotomy. Figure-of-eight contraction of bladder; lower segment indurated and necrotic. Autopsy,—sarcoma of left kidney.

CASE XXII.—Dr. A. J. McCosh. Female. Pain in the right iliac region; moderate pyuria. Catheterization of left kidney gave normal urine. No urine flowing through catheter in right ureter. This was left in position. Only three or four drops of urine were collected in as many hours, when catheter was withdrawn by mistake. Patient left hospital before diagnosis was made.

CASE XXIII.—Dr. W. P. Northrup. W., female. Had had all of the pelvic genital organs removed at different times. Complained of dragging pain in left lumbo-iliac region. One year ago ureters had been catheterized by Kelly's method, and patient assured of existence of left renal calculus. Our catheterization gave urines practically the same for both sides. Unable to support the diagnosis. (Brenner.)

CASE XXIV.—Dr. A. J. McCosh and personal. W. S., male. Hæmaturia and suspected disease of right kidney. Catheterization showed normal urine from both ureters, and a single large ulcerated lesion of bladder found. Believed to be syphilitic gumma. (Nitze, Brenner.)

CASE XXV.—Dr. G. E. Brewer. Male. Right renal fistula. Catheterization of right ureter gave no fluid as expected. Patient would not submit to catheterization of left. (Brenner.)

CASE XXVI.—Dr. C. K. Briddon. W., female. History of left renal lithiasis of seven years' duration. Six weeks ago severe pain in right lumbar region. Ureter catheterization showed well-marked chronic pyelonephritis on both sides, but much greater on the

right. Calculus the probable etiological factor. Urea excretion much less from right kidney. Right lumbar nephrotomy. One hundred and forty-nine calculi removed. (Brenner.)

CASE XXVII.—Dr. H. H. Morton. Male. History of grippe during convalescence; chills and sweats; moderate pyuria; right lumbar pain. Catheterization showed right pyelitis and secondary hyperæmia of the parenchyma. Recovery. (Brenner.)

CASE XXVIII.—Dr. J. Howland and personal. A. D., male. Tubercle bacilli had been found three weeks before in urine voluntarily passed. Strong suspicion of right kidney being tuberculous. Catheterization of both ureters twice failed to show tubercle bacilli. The same test made with Harris's segregator failed to give tubercle bacilli, but a marked pyelonephritis of the right kidney was proved by both instruments. (Brenner and Harris.)

CASE XXIX.—Dr. J. A. Bodine. J. T., male. For past ten years symptoms of right renal calculus. At different times he has passed small calculi. For past five years rheumatism of various joints. Catheterization showed a right pyelonephritis with triple phosphate and uric acid crystals. Clinical symptoms were strongly substantiated. A pyelonephritis without crystalline formations is also manifest on left side, but to a less degree than on the right. (Brenner.)

CASE XXX.—Dr. H. H. Morton. E. R., male. Four months ago dull aching pain in region of left kidney. Has valvular disease and has had much rheumatism. Has lost thirty pounds in six months. Urines from kidneys by catheterization are exactly the same, and correspond with that taken from bladder. All have trace of albumen, with some epithelial, hyaline, and granular casts. Examination of epigastrium reveals a pulsating tumor; infer aneurism and conclude left side pain due to nerve-pressure. (Brenner.)

CASE XXXI.—Personal. E. P., female. Sent to hospital with diagnosis of biliary calculus and empyema of gall-bladder. Urine segregator showed anuria on right side; normal urine on left. Ureter catheterization gave same result in addition to finding right ureteral obstruction at four inches, due to calculus. Nephrotomy. Ureteral hæmorrhages. Nephrectomy. Recovery. (Harris and Brenner.)

CASE XXXII.—Personal. N., male. Good family history. Never had urethritis. No diabetes for past five years; has noticed that he passes large quantities of urine, which is normal except for low specific gravity. Occasionally has sudden attacks of complete retention. Examination shows no enlargement of the prostate, stone, or posterior

urethritis. Desire to ascertain if one or both kidneys are involved in polyuria. Employed Harris's segregator. The patient cannot tolerate the presence of the instrument. Left epididymitis followed the test.

CASE XXXIII.—Dr. C. McBurney. L., female. Recent typhoid fever; exhausting bicycle ride; marked hæmaturia; right kidney pains; lumbar incision; kidney palpated, but not opened or punctured, because digital examination was negative. Moderate hæmaturia recurred; recovered six weeks later. Ureter catheterization now shows no evidence of hæmaturia, but trigonum, especially its immediate centre, is conspicuously congested and has many prominent blood-vessels. This is suspected as being the source of hæmorrhage. No hæmaturia when examined. (Brenner.)

CASE XXXIV.—Dr. J. R. Alvarez. L., female. Cystitis for years. Some tuberculosis in family. Eight years ago Dr. A. removed vesical calculus by vesico-vaginal route; two years ago increasing pyuria. Right lumbar region painful to palpation; kidney somewhat enlarged and movable. Immediately after menstruation considerable pain in region of right kidney; continues for three weeks, then free from pain for one week before next menstruation. Catheterization gives no fluid from right ureter; normal urine from left. There is not enough cystitis to account for quantity of pus in urine voluntarily voided. Examination points to calculus embedded in right ureter and ureteritis as source of pus in urine. (Brenner.)

CASE XXXV.—Dr. William B. Wood and personal. D. P., male. Syphilitic or tuberculous (?) laryngitis for ten years. Seven months ago commencing themuria, and urine became turbid. Three weeks ago patient had pain in region of left kidney. Catheterization of right ureter gives thick purulent urine which contains tubercle bacilli. Left ureter cannot be seen or catheterized on account of a small tumor occupying the position of the ureter-mouth. Harris's segregator employed; only difference between right and left urines; right showed tubercle bacilli, left not; right had 15 per cent. albumen by weight, left had 1 per cent. by weight. Same test with segregator three weeks later, tubercle bacilli then found in both right and left specimens. Nephrotomy on right side; improvement. (Brenner, Caspar, Harris.)

CASE XXXVI.—Dr. J. R. Alvarez. C. A. P., male. History of attacks resembling right renal colic due to calculus. Has had prolapse of rectum for ten years. Prostate moderately enlarged. Cathe-

terization of ureters not possible with Brenner's or Caspar's instrument. By Nitze's examining cystoscope we were unable to see the ureteral openings. Used Harris's segregator; worked well. After twenty-two minutes have collected twenty cubic centimetres from right side, twelve cubic centimetres from left; both turbid and slightly blood-stained. Blood probably from posterior urethra. Pathologist's report indicated the suspicion that urines had commingled in the bladder. (Brenner, Caspar, Nitze, Harris.)

CASE XXXVII.—Dr. P. Syms. McL., male. Five months ago pain in region of right kidney. Frequency of urination antedating two years; now amounts to less than hourly disturbance day and night. After cocainization irrigate the bladder, which will tolerate barely three ounces. Leave in two ounces, and pass cystoscope. Inflow of pus renders fluid rapidly turbid. Add another ounce of fluid through cystoscope, but it is ejected alongside. More cocaine, but bladder is intolerant. With two ounces in the bladder attempt to employ the Harris segregator. Great pain and vesical spasm make it necessary to remove this before the horns had been turned. (Brenner and Harris.)

CASE XXXVIII.—Dr. Forbes Hawkes. H. H., female. Dispensary malingerer who wished admission to the hospital. Gave history of renal disease. Catheterization showed both kidneys healthy. Some chronic cystitis. (Brenner.)

CASE XXXIX.—Dr. McCosh. Male. Sent by mistake of house-surgeon in place of another patient. Catheterization gave normal urine from each kidney. (Brenner.)

CASE XL.—Dr. McBurney. F., female. For past year intermitting hæmaturia, for last two months fairly continuous. Catheterization gave bloody urine from the right ureter, normal urine from the left. Dr. Sondern reports "careful search for the causative factor of the bleeding, but could not be found." (Brenner.)

CASE XLI.—Dr. Briddon. I., male. Patient had had what appeared to be a right perirenal abscess opened six months before. Now presents a tumor in the exact position for a considerably enlarged right kidney. Patient has a rising temperature, reaching 105° F., and more. Catheterization gives exactly the same urine from both kidneys. Nearly normal except for the bile they contain. By this examination we are able to exclude the kidney, and advise anterior incision. Chronic appendicitis and omental abscess found. (Brenner.)

CASE XLII.—Dr. McBurney and Dr. Newman. B., female. Two years ago noticed pain when lying on the left side. Six weeks ago sudden attack of left side pain. Quantity of pus in urine varies greatly. Catheterization gives a normal urine on the right side. Only a few drops of purulent urine are collected from the left, but aspiration through the catheter, while in the ureter, fills the same with the thickest grade of pus.

Pathologist's report was verified by Dr. McB.'s removal of a large unruptured pyonephrotic kidney in the pelvis of which was wedged a stone. (Brenner.)

CASE XLIII.—Dr. G. A. Tuttle. I., female. Urinary tuberculosis; pain in left hypogastrium. Neurasthenic. Catheterization failed because as soon as catheter had entered ureter patient insisted upon changing her position. (Brenner.)

CASE XLIV.—Dr. McCosh. Male. Vesico-rectal fistula. For four months fæces and air issued at times from the meatus. First examination with cystoscope sudden and occluding bleeding. (Brenner.)

Second examination: No bleeding, but a vesical tumor held the cystoscope so firmly against anterior vesical wall as to convince us there was no prospect of catheterizing the ureters. Suprapubic operation revealed a tumor running longitudinally in rectovesical septum and rising high on floor of bladder. (Brenner.)

CASE XLV.—Dr. Purdy. J. C., male. Urinary tuberculosis; very frequent urination and great urethral distress. Urethroscopy showed tuberculous ulcerations in prostatic and anterior urethra. Local anæsthesia believed to be insufficient for ureter catheterization or any form of cystoscopy. Examination deferred. Patient sent to country.

CASE XLVI.—Dr. Crain. P., male. Patient has had some renal symptoms in connection with vesical ones dependent upon tabes. Contraction of external vesical sphincter so persistent as to preclude passage of the cystoscope. (Brenner.)

CASE XLVII.—Personal. B., male. Good health until fifteen years old. At that time malaria and contracted gonorrhœa, which was light and disappeared without treatment. For the following three or four years had good health, but drank heavily, and masturbated. At age of nineteen irregularities of urination first noticed; frequency day and night. For the succeeding three years he indulged immoderately in other vices. He had had various kinds of

treatment. Suprapubic cystotomy and drainage. We first believed his condition would prove to be tuberculosis of the urinary tract, but ureter catheterization showed the kidneys not diseased. A marked cystitis involving the trigonum especially, and very rebellious to treatment.

CASE XLVIII.—Personal. G., female. Complained of severe epigastric pain and tenderness over the middle and lower dorsal spines; some slight kyphosis. No urinary symptoms. On examination of urine we found tubercle bacilli besides the slightest degree of pyuria. Upon attempted ureter catheterization the urethra was so sensitive and patient so intolerant, despite cocainization, that the attempt was desisted from before illumination of the cystoscope. (Brenner.)

CASE XLIX.—Dr. C. K. Briddon and Dr. E. Eliot. M. G., female. Pain for past five years in right umbilical region. No urinary symptoms. Moderate gastric symptom. At times an indistinct soft tumor can be felt at seat of pain. Opinions differed as to involvement of gall-bladder or kidney. Catheterization of right ureter gave no urine until catheter had passed a stricture not far from kidney. Then flow was free and continuous. Considerable pressure necessary with smallest catheter to pass the stricture. Hydronephrotic urine. That from left kidney normal. Nephrotomy followed by nephrectomy. Recovery. (Brenner.)

CASE L.—Dr. A. J. McCosh. R., male. When eight years old fell thirty feet, struck on abdomen across a swinging door. Five years later was seized with a severe pain in left side and lumbar region. This became enlarged and was tender to touch; lasted two days. At that time such attacks every two months. Of late an attack every week.

Eight months ago he had the first seizure of a similar nature on opposite side, but these have never been so severe. Vomiting at once attends the attacks. Catheterization of left kidney. No urine until catheter has passed ten inches up the ureter. Rapid and continuous flow of light urine. Collected 200 cubic centimetres in eight minutes. Withdrawn catheter one-half inch; flow ceases. Again advance it past obstruction and drain as much more. Catheterization of right ureter. Urine flows at once, but intermittingly and in normal fashion. Operation on left showed large hydronephrosis. (Brenner.)

CASE LI.—Dr. M. J. Jackson and personal. F. O., male. Entered hospital with agonizing pain deep on right inguinal region. Nature of seizure suggested lodgement of calculus low in right ureter. Rectal examination elicited a point of great tenderness referred to ureter, but no stone felt. Catheterization showed no obstruction in ureter; both urines practically the same. Pains which were not relieved by considerable doses of morphine continued; two days later patient died suddenly with some symptoms of apoplexy. Autopsy showed retroperitoneal rupture of a small but extensive dissecting aneurism of the lower part of abdominal aorta. (Brenner.)

CASE LII.—Personal. O. W., female. For past year has had increasing vesical pain and frequent dysuria. Catheterization gives normal urine for both kidneys. Cystoscope shows at same time a cystitis, due, apparently, to colon-bacilli infection. Irrigation. Left hospital with normal control of bladder and no pain. (Brenner.)

CASE LIII.—Dr. C. L. Gibson. C. S., male. Family history good. Eighteen years ago a severe strain over left lumbar region, and was disabled a short time by it. During subsequent eighteen years he suffered several severe illnesses, always seeming to emanate from the left kidney. Fever, pain, and loss of weight were noted. Side was more and more painful at each attack, some of which lasted three and four weeks. No urinary symptoms except a trifling degree of frequency, amounting to two and a half hours. Moderate pyuria was noted. Had had kidney examined by needle-puncture for stone. Urine passed voluntarily at this time showed marked trace of albumen with some hyaline and granular casts. Catheterization of right ureter gave normal urine. The left ureter-mouth was invisible, and attempts to enter it with the catheter failed. Knowing that the patient had a sound right kidney, Dr. Gibson performed left nephrectomy. Completely destroyed organ found. Recovery. (Brenner.)

CASE LIV.—Dr. G. A. Tuttle and personal. Female. Some tuberculosis in family history. For past year and a half has had frequent urination and pain in back. Symptoms of malaria had led to treatment for that disease. In Presbyterian Hospital Dr. Tuttle found a few tubercle bacilli in her urine. Catheterization of her right ureter gave evidence of pyelonephritis, and tubercle bacilli were found. Urine from left ureter normal. No evidence of cystitis. Patient accepted a proposed nephrectomy, but family objected and removed her from the hospital. (Brenner.)

CASE LV.—Dr. W. T. Bull, Dr. J. B. Walker, and personal.

Male. Family history negative. Fifteen years ago patient had appendicitis. Six months ago he was first annoyed with *thamuria*, which has increased until at present time urination occurs hourly day and night. Bladder tolerates but one and a half ounces of irrigation fluid. Catheterization of right ureter gives faulty urine containing tubercle bacilli. Urine from the left ureter is normal. Right nephrectomy; recovery. (Brenner.)

This series, presented for examination without the employment of general anæsthesia, shows fifty-five cases,—twenty-eight males; twenty-seven females.

Of the fifty-five there were two male cases where the conditions were such that no attempt was made to pass urine-collecting instruments. In eight other cases, five males and three females, the attempt to collect separate urines failed completely. In two of the male cases the ureter cystoscope could not be passed through the urethra. In another male the median situation of a vesical carcinoma and bleeding defeated the attempt. In another male rapid and excessive pyuria from the left kidney, together with irritable bladder, made catheterization impossible. The remaining male case where we failed completely presented every favorable condition, except that there had been for a long time prolapse of the rectum, resulting in a depression of the trigonum to an unusual level behind a moderately enlarged prostate. Here with different instruments the ureter-mouths were inaccessible and invisible.

As to the three failures in female patients, one case insisted upon withdrawal of the instrument from the bladder before it had even been illuminated. Another was nearly as nervous, and demanded to have her body position changed after only a drop or two of urine had been collected from each side.

The third was examined under hasty and unfavorable hospital conditions. The first time a stricture of the urethra prevented the insertion of a cystoscope. The second attempt was too soon after urethrotomy, when incontinence and bleeding rendered it futile.

Upon the fifty-three cases where examination was attempted some one of the following instruments was used:

Sometimes the same instrument more than once on the same patient; in a few cases several instruments were used,—Brenner's on forty-eight cases; Caspar's on four cases; Nitze's on two cases; Harris's on six cases.

The reasons for using Brenner's ureter cystoscope so generally may, without detracting from the value of other kinds, be explained by the following facts: It is of small circumference and easy to introduce. By it ureter catheterization can be accomplished with a minimum amount of distending fluid. (We have twice succeeded with so little as forty-five cubic centimetres.) The catheter-channel when unoccupied by the catheter serves well for preliminary irrigation and evacuation of the bladder. The relatively high level of the ocular end of the instrument, when in use, tends to counteract leakage along-side the catheter. Again, because the catheter-channel has but a single easy curve bending and binding of the catheter are largely obviated.

Now as to the visual possibilities of the instrument: We find that it is easy in more than half the cases to see the ureteral opening and to readily engage the catheter. In a less number it is fairly easy to recognize the exact position of a ureter-mouth by the vesical topography and by seeing a small dark mound outlined against the more illuminated vesical field beyond it. In a small number of cases, where the ureters can be neither seen nor anatomically located, it is still possible at times to insert the catheter. The instant this is done the fact is made apparent by a slight dome of mucous membrane rising above the advancing catheter just as soil or turf lifts over a burrowing ground mole.

The fact that in those cases where we failed with Brenner's instrument we also failed with Caspar's and Nitze's assures us the whole number of successes would not have been any greater had any other form of ureter cystoscope been used the same number of times as was the Brenner.

While employing this latter ureter cystoscope in some cases of small capacity, irritable bladders, we often wished that the instrument had a second catheter-channel through which the distending fluid might be led from the bladder to relieve

the patient during the time the catheter was in one ureter making its slow collection.

This led us to plan a new instrument having a double instead of a single-barrelled catheter attachment. Drawings for this modified Brenner, together with other alterations of technical convenience, were forwarded to Leiter & Co. early in the year. (Figure 12.)

We hope it may serve the following purposes :

(1) In favorable cases to catheterize both ureters at approximately the same time.

(2) In less favorable cases after passing one catheter to use the second channel for drawing the distending fluid from the bladder, thus giving the organ repose.



FIG. 12.—The author's double-barrelled ureter cystoscope, cocks open ; catheters in both barrels (1899).

(3) In still more difficult cases to use the second barrel for frequent irrigations until fluid of proper transparency distends the bladder and permits localization of the ureter, when a catheter, which has been reposing in the other barrel, can be made to engage the ureter. By taking hasty advantage of a momentarily clear fluid success may be made of an otherwise failure.

(4) In some of the impossible cases, or where for various reasons but one ureter can be catheterized, this double-barrelled instrument would in the latter case permit access to one ureter through one canal, and urine coming into the bladder from the opposite kidney could be collected from that source by catheter siphonage through the second barrel.

Both barrels could be utilized for this sort of indirect uri-

nary collection through parallel catheters, providing the intervening vesical ridge were lifted from within the vagina or rectum, as in Dr. Harris's device, the visual properties of the cystoscope being first utilized to ascertain the condition of the bladder. The instrument is but one and a half millimetres greater circumference than Brenner's.

THE MECHANISM OF FRACTURE OF THE NECK OF THE RADIUS.¹

By EUGENE R. CORSON, M.D.,

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THROUGH the courtesy of Dr. James G. Van Marter I have had an opportunity to examine, by the X-ray, an elbow-joint where this comparatively rare fracture has occurred. A negro, about twenty-five years old, thrust his right arm into a rapidly revolving cylinder. The arm was violently jerked and rapidly circumducted, and when liberated was found to have sustained a backward dislocation of the elbow. This was at once reduced, under chloroform, and the joint put up in plaster of Paris, the forearm at a right angle with the arm, and midway between pronation and supination. He was sent to me for an X-ray diagnosis. An excellent skiagraph, here reproduced, and a fluoroscopic examination of the movements still permitted the joint, leave no doubt of the diagnosis and of the present condition of the parts.

An uncomplicated fracture of the neck of the radius must be rare. Covered by thick muscles, and its ligaments permitting a free movement of the proximal end of the bone, a force sufficient to break its neck must either dislocate the joint or break the other bones composing it. The fact that the neck of the bone forms no angle with its shaft makes quite impossible an uncomplicated fracture of the neck from a force transmitted the length of the bone, a fracture of common occurrence in the femur, where the angle between neck and shaft is so marked, especially in old people. Many fractures occur through ligamentous strain, and the present fracture must come under this head. It is, therefore, to the orbicular ligament and the external lateral ligaments we must look for a solution of the

¹ Read before the Georgia Medical Society, 1899.

problem. It is evident that a force which can put the orbicular ligament on the stretch and strain the neck of the bone may act in two ways, either by forcing the radius away from the ulna, which remains comparatively fixed, or by forcing the ulna away from the radius, which is fixed against the radial head or the external condyle of the humerus. The former condition is produced by a dislocation of the radius outward or by a sudden and violent over-supination of the forearm. Try to over-supinate the forearm, and you are at once conscious of a strain at the radial head; over-pronation does not produce this strain. The latter condition is produced when the ulna is dislocated backward or inward with the radius fixed. Again, with a violent backward dislocation of the ulna, it is easy to see how the head of the bone can be simply torn off from the neck, exactly what has taken place in the present case, a clean transverse fracture of the neck immediately below the head, which has suffered some comminution. Judging from the skiagraph, the superior articulating surface of the head is intact.

Backward dislocation takes place more readily with the forearm in extension, with the tendon of the biceps inserted into the tuberosity of the radius on the stretch. The radius is held by the head and by the tuberosity, and a force at right angles between these two points may well cause a fracture. Therefore we can well imagine how a combination of these two forces—namely, a backward dislocation with the arm in extension, with a sudden and violent outward rotation of the forearm,—that is, a forced supination—would be quite sufficient to produce this fracture.

The history of the injury in this case points to this combination. The arm in extension was thrust into a rapidly revolving cylinder, where a violent jerk and rotation of the arm dislocated the ulna backward and tore off the head of the radius. The conditions were unusual, just as the fracture is an unusual one. It is evident that no direct blow caused the break. With the various dislocations at the elbow, it is easy to see how the orbicular strain on the neck of the radius must vary. In the dislocation of the radius alone this strain is probably never much, on account of the free play of the bone



Fracture of the neck of the radius.

within its ligament. With the dislocation of the ulna alone, and especially backward, this strain must be much greater, especially as the radius tends to remain fixed against the radial head or external condyle of the humerus. Again, where the two bones are dislocated together, the strain must be less; it rather presupposes that the orbicular ligament and the radius are intact. From the appearances in this case, we are led to believe that the head was torn off from the neck, and that this must be the usual way the accident occurs.

In pre-Röntgen days injuries of the elbow-joint often offered difficulties in the way of diagnosis wellnigh insurmountable. I have had in my office an elbow-injury awaiting an X-ray diagnosis, where four physicians failed to agree as to the nature of the injury. Hamilton mentions several cases where an absolute diagnosis was unattainable. This joint being complicated by a third bone, the radius, and thickly covered with muscles on its anterior surface, it offers peculiar difficulties in the way of diagnosis. With the advent of the X-ray, however, these difficulties have vanished, and no case to-day need go begging for a verdict. The elbow-joint is especially favorable for the X-ray, and it is certain that we shall have many more cases of fracture of the head or neck of the bone than formerly, simply because the cases will be diagnosed.

The comparative rarity of fracture of the neck and head of the bone seems due to the fact that it enters only indirectly into the formation of the elbow. The joint proper is composed of the humerus and ulna, these two bones being closely united by firm ligaments, while the radius is only a hanger-on, with a large, free play of its own. Again, an inspection of its head, with its smooth and well-rounded edges, set directly on the neck, calls forth considerable respect for its strength in a rough-and-tumble encounter with its two companions. If driven against the lesser sigmoid cavity of the ulna, it would require a severe blow directly on the head from the outside to break it; while in the common occurrence of falls upon the hand, the head of the bone being driven against the radial head of the humerus, the blow is apt to be a glancing one. It is the lower end of the bone which usually suffers.

Fracture of the head, however, is more common than fracture of the neck, and this fracture is usually in the long axis of the bone. It is rarely caused by a direct blow, but results from an indirect force, dislocating the elbow, or breaking the lower end of the humerus, or one or both condyles, or the olecranon, or the coronoid process. All of these fractures are more common than fracture of the head or neck of the radius.

Hamilton writes: "While, therefore, the presence of what appear to be the rational diagnostic signs has compelled me to record one case of an uncomplicated fracture of the neck of the radius, and two others as fractures at this point, accompanied either with a fracture of the humerus or a dislocation of the ulna, I am prepared to admit that some doubt remains in my own mind as to whether, in either case, the fact was clearly ascertained."

The X-ray will dispel all this doubt, and will settle the relative frequency of this fracture.

The skiagraph which I present is a very satisfactory one. It shows plainly a transverse fracture of the neck, just below the head, which is comminuted, though the ring shadow of the superior articulating surface would indicate that this part is unbroken. This skiagraph gives you strongly the impression that the head has been torn off from the neck in the backward dislocation of the ulna. During the act of dislocation or its reduction the fragments have been displaced forward and upward. The humerus is intact. As to the ulna, I am in some doubt. If the coronoid process is fractured, it is still held in place by the periosteum and ligaments. The reposition of the humerus and ulna seems quite perfect, but in examining the joint through the fluoroscope, the joint surfaces do not glide normally over each other in the flexion and extension, still left the patient. The space between the bones widens out from a point where the coronoid process comes in contact with the trochlear surface. In the limited pronation and supination the separated head does not move with the shaft.

An examination of the patient, eight months after the injury, shows a very fair function of the joint. The forearm

can be brought up to a right angle with the humerus, and extended to within 20 degrees of complete extension, giving good 70 degrees of flexion and extension. Pronation and supination are very little, not over 10 degrees.

A word as to the treatment of this case. The dislocation was reduced at once under chloroform, the forearm at right angles to the arm, midway between pronation and supination, held securely by a splint, the best position in case of impaired function of the joint. The joint will probably still improve somewhat with time and use. It is not impossible that the loose fragments of bone will be absorbed. The patient declined an operation for their removal.

PROPERITONEAL AND INTERSTITIAL INGUINAL HERNIÆ.

BY VAN BUREN KNOTT, M.D.,

OF SIOUX CITY, IOWA.

PROPERITONEAL or, as it is, perhaps, more commonly designated, interstitial inguinal hernia is of comparatively rare occurrence, and a search of the literature upon the subject would seem to indicate that its importance has not been sufficiently emphasized.

In 1835, Dance published a brief description of interstitial inguinal hernia, but the first paper, thoroughly describing this condition, was read by Goyrand, before the Paris Academy of Medicine, in 1836. Following his article this variety of hernia for many years was commonly called "Goyrand's hernia," and a few scattered cases reported.

In 1876, Krönlein reported two cases that had come under his observation, and briefly described the characteristics of this class of hernia. Following this, in 1881, the same author published histories of twenty-four cases, which he had been able to collect, together with an exhaustive review of the etiology and pathology of this condition. This paper remains to-day the most complete and valuable article published upon the subject.

In 1895, Murray reported a case which had come under his observation.

In 1896, W. Breiter published a valuable paper on this subject, which was reviewed by White, of New York. He reported thirty-five cases of properitoneal and interstitial hernia, which he had been able to collect, in addition to the twenty-four previously reported by Krönlein, and made some valuable

deductions from the histories of these fifty-nine cases, which were all that had been reported up to that time.

In 1897, A. E. Barker presented an article describing this variety of hernia, and reported two cases. The same year N. S. Scott contributed an interesting paper, urging the importance of recognizing this condition, and reporting one case.

Most modern text-books of surgery dismiss the subject of properitoneal hernia with a very brief and often misleading description, and few recognize the danger which may result if the real nature of the hernia is not recognized. By some surgical writers, notably Treves and Moullin, these herniæ are not even mentioned.

Properitoneal or interstitial inguinal herniæ may be conveniently separated into two classes, determined by the anatomical location of the sac. In the first group should be placed those herniæ which lie between the peritoneum and the transversalis fascia. In the second group should be included those cases in which the hernial sac lies between the planes of the abdominal muscles or between the muscles and the skin.

By many authors no attempt at classification is made, and both varieties are included in one group, regardless of their anatomical relations. Bull and Coley classify these herniæ into three groups; the classification depending upon the relative position of the sac :

(1) When the sac is found between the peritoneum and the transversalis fascia.

(2) When the sac lies between the internal and external oblique muscles.

(3) When the sac is between the aponeurosis of the external oblique muscles and the skin.

The simpler classification into two groups would seem better, as while it makes a very considerable difference whether the sac is between the peritoneum and transversalis fascia, or between the internal and external oblique muscles, or outside of these muscles, it matters very little in which of the last two positions it is found. By adopting this classification as sug-

gested, we may do away with the uncertainty regarding the name to be applied to these herniæ, and call all herniæ of the first group properitoneal; and those of the second group interstitial, inguinal herniæ. They will be so designated in the remainder of this article.

Properitoneal inguinal herniæ are of much less frequent occurrence than those of the interstitial variety and are much more difficult to recognize, as the unusual position of the sac in the former is not often indicated by a visible tumor, which is nearly always present in the latter. Both varieties occur almost exclusively among men, as, in the fifty-nine cases before mentioned, there was but one woman.

Etiology.—Both varieties are usually attended by an undescended testicle, which, by presenting an obstruction to the descent of the sac through the canal, is probably frequently responsible for its atypical position.

M. Schmidt, after a careful study of the histories of all reported cases, concludes that, in a great many of them, the unusual position of the sac is due to a dislocated internal ring, and that in these cases the common opening of the two sacs into the abdominal cavity is the displaced internal ring. He says that this dislocation of the ring could be responsible both for the retentio testis and the characteristic form of the rupture.

To account for such displacement of the internal ring he assumes a faulty insertion of the inguinal band of the primordial kidney.

Stroebel advances the following theory as to the causation of these herniæ: The inguinal sac is first developed, and the properitoneal sac is secondary through the loosening of the neck of the hernial sac from the internal ring, and through the bulging of the wall of the hernial sac behind the abdominal wall and in front of the peritoneum. This loosening of the sac is favored through cicatricial contraction of the ostium abdominale of the sac whereby reposition is impeded; through wearing a poorly fitting truss, which only closes the external ring and not the entire canal; through retention of the testicle,

which acts as a barrier to the descent of the contents of the hernial sac into the scrotum; through any agency which closes the external ring, leaving the internal ring open; through traction exerted by the peritoneum when it has become adherent to the neck of the hernial sac.

The above theories agree in most essential points, and are the most rational that have yet been offered in explanation of the etiology of these ruptures.

The dislocation of the internal ring may also be due to violent and unskilful efforts at taxis, and the hernial sac forced out of the inguinal canal.

Schmidt mentions a case of properitoneal hernia which followed rupture of the septum, between the hydrocele and the abdominal cavity, in a case of hydrocele of the spermatic cord.

The diagnosis of these herniæ is of great importance, particularly if strangulation exists.

Properitoneal hernia may be unaccompanied by any visible swelling, and no signs of its presence may exist until symptoms of strangulation appear. As we have seen, it occurs almost invariably in men, and is frequently associated with an undescended testicle. Hence, when these conditions are present in any given case, the possible existence of this form of hernia should be borne in mind.

Properitoneal inguinal hernia may present a tumor in the inguinal canal, due to the presence of intestine in the lower part of the sac.

When strangulation has occurred and the hernia has apparently been reduced by taxis, but the symptoms of obstruction do not in the least abate, it would be well to consider the possibility of having forced the contents of the lower portion of the sac into the upper, which, being behind the entire thickness of the abdominal wall, may not exhibit any swelling, and encourage the belief that complete reduction has been made. As the constriction is usually at the common opening of the two sacs into the abdomen, the strangulation is still unrelieved and the symptoms will not ameliorate. This is probably what

occurred in the reduction *en masse* spoken of by the older authors.

That the diagnosis of these cases is difficult is proven by the record of the twenty-four cases collected by Krönlein, in only one of which was the diagnosis made during the life of the patient, although four were operated upon. It is extremely important that the diagnosis be made at the earliest possible moment when strangulation is present, and that the false sense of security, which has followed the apparent reduction of the hernia, should be at once dispelled by the continuance of the signs of obstruction. Bull and Coley report two cases in which, the patients presenting symptoms of strangulation, taxis was made and reduction was thought to be complete; the symptoms eventually recurred, and, although operated, both cases ended fatally.

Interstitial inguinal herniæ are, as a rule, less difficult of diagnosis than the foregoing. There is usually present a more or less characteristic tumor in the inguinal region, which extends from the spine of the pubis out towards the anterior superior iliac spine. It may, and often does, overlap Poupart's ligament; or it may extend well up into the abdomen, but, as a rule, it lies parallel with Poupart's ligament. The swelling may be apparently separated into two portions by what may appear to be a constricting band crossing it. In one of the cases reported by Barker this division was made by the deep epigastric artery and vein crossing the sac at about its centre. The swelling may not extend below the external ring, but frequently descends well into the scrotum. This variety of hernia is also more common in men than in women, and is found more frequently upon the right than upon the left side, usually associated with an undescended testicle. The contents of one portion of the sac may be forced into the other, causing that part of the tumor to increase its size. The same danger here exists as in the properitoneal variety, though to a less extent; that when strangulation has occurred efforts at taxis may cause the contents of the lower sac to be reduced into the upper, and complete reduction into the abdomen thought to have been effected.

Usually the swelling will persist above Poupart's ligament, indicating that the reduction is not complete.

All external signs of a hernia may, however, disappear, at least for a time, as evidenced by the following case :

J. B., German, farmer, aged sixty-four, January, 1897, while walking around the streets of Sioux City, was suddenly seized with violent pains in the left inguinal region and fell to the ground. The symptoms of intestinal obstruction rapidly supervened, and he was carried to the office of a physician near by. Upon being questioned, he stated that he had had a left inguinal hernia for fifty years; that it had never occasioned him much inconvenience, and that he had never worn a truss; that he believed it had always "gone back" at night.

Upon examination the physician found a large hernia descending about half-way into the scrotum on the left side well up into the inguinal region. After persistent efforts at taxis the swelling disappeared, and the patient was told that he would soon feel better. The symptoms of obstruction, however, did not abate, and the man complained more bitterly than before. He was then sent to the hospital, where I saw him about 6 P.M. At that time there was a large sausage-shaped tumor occupying a position just above and parallel to Poupart's ligament, and extending from the pubic spine out to and even beyond the anterior superior iliac spine. The skin overlying this tumor was dark red in color. The house surgeon said that when he was admitted, about 3 P.M., there was little or no swelling visible, but that it had soon appeared, and was constantly increasing. The general condition of the patient was rapidly becoming worse; shock being pronounced. The testicle was absent from the scrotum on the affected side, and the patient stated that it had never been down. Gentle taxis proved unavailing; he was rapidly prepared for operation.

Upon incision the testicle was encountered just inside the internal ring; as it was atrophied, it was removed. The incision was extended outward and the sac exposed, lying between the external and internal oblique muscles. The sac being incised, a large quantity of dirty-looking serum poured out, and about eight inches of dark, almost black, intestine were revealed. A finger was passed into the sac and search made for the point of constriction. This was found,

only after considerable difficulty, very much higher than usual, and displaced towards the left. The incision was extended still farther, and the constriction, which was located at the corner mouth of the two sacs, incised. The gut soon showed evidence of returning circulation, and was returned into the abdominal cavity. That portion of the sac lying between the external and internal oblique muscles was very thick, and was spread out over a large area; it was everywhere firmly adherent to the surrounding tissues, and was dissected out with considerable difficulty, cut off at the neck, and the stump returned into the abdomen. The inguinal canal was then obliterated with chromicized catgut sutures, and the internal wound closed.

Primary union took place, and the patient made an uneventful recovery.

This case well illustrates the danger attending herniæ of this class when strangulation has occurred. A delay of a few more hours would greatly have lessened the chances of recovery, and, although the operation was performed within five hours after the first symptoms of obstruction appeared, the vitality of the gut was so lowered by the extra pressure following its incomplete reduction, in addition to the original constriction at the internal ring, that the propriety of returning it into the abdomen was, for some time, in question. Had not the tumor reappeared, it is altogether probable that operation would have been deferred too long.

In all cases of inguinal hernia presenting an unusual location, or shape, of the sac, great care should be exercised that a reduction of a portion of the contents of the sac into another compartment of the same be not mistaken for a complete reduction into the abdomen.

I believe that all cases of properitoneal or interstitial inguinal herniæ, whether strangulated or not, should be immediately subjected to an operation, as thereby the unusual dangers of this condition are minimized.

The application of a truss in these classes of herniæ is thought to be unjustifiable.

Though these varieties of herniæ are of comparatively rare

occurrence, the importance of recognizing them when seen is very great. The above case is the only one I have ever seen in a great many operations for rupture. Barker states that, in several hundred operations for hernia, he has only seen two cases; and I have been able to find mention of but sixty-six cases so far reported.

ON THE PROPER WIRE FOR INTRODUCTION INTO AN ANEURISMAL SAC.

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THE following case will explain the reason for undertaking the experiments presented:

A negro, of forty-nine years, had been ill for two years. Nine months before entering the hospital an abdominal tumor had been discovered, and two months before admission it had been correctly diagnosed aneurism of the abdominal aorta. It was plainly visible as a dome-shaped swelling in the upper umbilical region, about fifteen by ten centimetres. He suffered so much that he was kept continuously under the influence of morphine. Dr. Hare's address, delivered at Columbus in May, 1898, had just appeared, advocating the use of wire and galvanism in such cases, and it was for this treatment that the patient was sent to the hospital. He was very weak and emaciated, and it was only as a last resort that the operation was undertaken.

Under Schleich's anæsthesia a button-hole incision through the linea alba, just above the umbilicus, was made. The tumor was overlaid by omentum, to which and to intestine there were a few adhesions. An old, hollow perineum-needle, provided with a ratchet-wheel for delivering the wire through it, was introduced, and being .031 inch in diameter, permitted considerable hæmorrhage through it; but this soon ceased through clotting. Having no definite guide as to the character of the wire to be introduced (only an abstract of Dr. Hare's paper having reached our hands), silver-plated, soft, copper wire, .016 inch in diameter, was used, and seven feet introduced before a hindrance occurred. The wire was now attached to the positive galvanic pole, and the current gradually increased to 80 milliamperes, at which

it was kept for fifty minutes. Not much suffering was caused by the current, except on one occasion, when it was advanced to 110 milliampères for a few moments. After fifty minutes syncope was threatened, and the *séance* was discontinued. Distinct firmness of the tumor had occurred, as well as a disappearance of the expansile pulsation, and the hollow needle encountered considerable resistance when it was moved from side to side, showing that the desired clotting had occurred. Bleeding was free for a short time after withdrawing the needle, but ceased when the incision was closed. Before the suturing was begun the end of the wire was buried, as far as possible, in the sac wall.

The patient lived twenty-four hours, during which time the pain was the same as before the operation. The pulse was rapid and thready throughout, and the skin cold, but the mind clear. The following is extracted from the pathologist's report: "An aneurism of the abdominal aorta, two inches above its bifurcation. A wire, irregularly twisted, occupied the centre of the sac, surrounded by and mixed with old and recent clot; one end, together with a double loop of wire, passed up the aorta, the looped part reaching about ten inches, and the single strand quite up to the aortic valves of the heart, where it left a spot of ecchymosis. The aneurism was distinctly sacculated; the opening from the aorta into the sac being not over one inch in diameter."

How desirable might knowledge be in regard to the kind of wire to be used was now plain, and the following experiments were instituted in consequence.

A calf's bladder was stuffed with "excelsior" shavings, and hardened in wood alcohol. After removing the packing the incision in the viscus was sutured, and the organ lightly supported, on all sides, by shavings, and the whole placed in a small basket. The leathery sac so supported, about twelve and one-half by seven and one-half by five and one-half centimetres, fairly represented an aneurismal sac and an opening in it one and one-half centimetres in diameter, where the urethra had been, permitted the experimenter to see how wire thrust in might behave. Some of the trials may seem foolish from the size or material of the wires, but the object was to see how all sorts might behave, and so gain hints as to the making of a

suitable wire. The first question was as to the choice between a wire with temper, which would recoil in a spiral form within the sac, its stiffness being the cause possibly of injury, and a perfectly soft wire, which might be made to fold irregularly upon itself, and yet could not transmit any force applied to it.

(1) A tempered steel piano or mandolin wire, .0115 inch in diameter, was passed into the artificial aneurism, through a fine aspirator-needle, .0315 inch in outer diameter. Eight feet entered without hinderance, and roughly recoiled within the cavity, and as it *must* be removed, the trial was made of withdrawing it through the needle. This succeeded. On repeating the experiment an occasional catch was easily overcome by slightly withdrawing the wire; on the second withdrawal it became kinked, so much so as to prevent removal.

(2) Same kind of wire, .0155 inch in diameter. After one foot had entered it caught so fast as to be immovable. Second and third trial of same gave the same result. Altogether too large for the needle and for the purpose intended.

(3) A fine tempered steel wire, .0085 inch in diameter, made for musical instruments and called Hartmann's combination spool, No. 00. On first trial four feet were introduced without a hitch occurring in or out. On the second trial six feet were introduced with one slight hinderance, and the same on withdrawal. On the third trial a much smaller needle, a hypodermic, was used, .0225 inch in diameter, and seven feet went smoothly in. Coming out it caught once.

(4) The finest brass wire which could be easily obtained, soft and .0175 inch in diameter, was too large for either needle. Five feet were introduced and withdrawn twice very smoothly through a perforation in the sac wall.

(5) Martin & Co.'s (Cleveland) soft iron wire of blue finish, spool No. 32, measuring .013 inch. Though not tight in either needle, it cannot be pushed through because of lack of resiliency.

(6) Soft iron wire for artificial flowers, .008 inch, though fine, sticks in the smaller needle for the same reason.

(7) Soft copper wire, No. 30, .0115 inch, fails in the larger needle, because too soft.

(8) Martin & Co.'s soft copper wire, .0085 inch, of most beautiful, soft, hair-like consistence. Though loose in both needles, it has not enough stiffness to be advanced when it impinges on the wall of the sac.

(9) Soft copper wire, .0175 inch, though large, fails in the same way.

(10) Soft copper wire, .02 inch, requires too large a needle.

It is evident, then, that soft wire of any grade will not do, because it cannot be projected into the sac. Tempered wire, if straight, may penetrate the tissues, so that it must be coiled before using, in hopes that it will recoil within the cavity.

(11) Silver wire, of 925 purity and of moderate temper, was drawn in imitation of the previous wire, which had given most satisfaction,—viz., that in Experiment 3, but its diameter was about .011 inch, and size approximately No. 29. Thirty-six inches passed in smoothly through larger needle; coming out it caught once. On second trial it passed both ways smoothly.

(12) Twelve-carat gold wire of moderate temper, about No. 29, and .01 inch in diameter, twice caught when two and a half inches were passed through the finer needle, partly, because too soft. It passed the larger needle smoothly, but stuck slightly on withdrawal. It was not as easy to imitate the wire of Experiment 3 in gold as in silver, because of difficulty in drawing so fine.

In no case did wire escape from the opening in the sac, showing that no dangerous pressure was exerted on the walls. But this was due, no doubt, to the precaution of winding the wire on a spool before inserting it.

The expense of a gold wire seems unnecessary. In order to test the loss to the silver wire through solution while under the action of the current about thirty centimetres of the above wire weighing .754 gramme were placed within fresh beef and moistened with a normal saline solution, and a current of eighty milliamperes passed for eight minutes. The loss was but .0002 gramme, which for nine feet one hour would be roughly .00576 gramme, certainly not an amount which could be deleterious to the system. And as for remaining in the tissues, certainly silver wire has been long enough used in that way to establish its reliability.

A silver or gold wire, then, about .0085 inch in diameter, and of sufficient temper to retain its coil, would seem to be all that is required to fill, when carrying the positive galvanic current, an aneurism with clots, and is not so thin as to be in dan-

ger of breaking. It is suggested that the easily obtained music wire previously mentioned be taken as a sample.

[NOTE.—Before these experiments were completed the article of Dr. D. D. Stewart, in the *British Medical Journal* for August 14, 1897, fell into my hands. Therein he comes to a similar conclusion in regard to the character of the wire to be used, though arriving at it by a different course. In the *Philadelphia Medical Journal* for March 4, 1899, is narrated difficulty from the kinking of wire.]

NITROUS OXIDE AND ETHER ANÆSTHESIA BY THE OPEN METHOD.

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IN the selection of an anæsthetic, safety is the consideration of first importance. Of the three general anæsthetics in common use, nitrous oxide, with a mortality of only one in 5,000,000, stands first, not only in safety, but in ease of administration and in freedom from effects unpleasant to the patient. For short operations it is an ideal anæsthetic, but the danger, rapidly increasing as the time is prolonged, has for the most part precluded its use in operations of more than a few minutes' duration.

In the minds of the American surgeons, ether retains its place at the head of the list of anæsthetics for prolonged operations. Its mortality varies from one in 5000 to one in 15,000, being greatest when administered by the closed method.

Chloroform, with a mortality of one in 1500, must be considered a dangerous anæsthetic. When used in this country, it is usually to avoid the long time required for administration, the suffering and struggles of the patient, and the unpleasant after-effects which attend the use of ether. These are objections to the use of ether, which are more evident to the patient than to the surgeon, but are of sufficient importance to warrant their consideration next to that of safety in the choice of the anæsthetic.

By preceding ether anæsthesia by nitrous oxide, it is found that the following advantages are obtained:

- (1) The safety of ether anæsthesia is increased. At St.

Bartholomew's Hospital, when the mortality of ether alone was one in 2830, that of nitrous oxide and ether was only one in 12,941.

(2) The time required to induce anæsthesia is reduced to from two to three minutes.

(3) The uncomfortable sensations and sufferings of the patient are done away with.

(4) The nausea and vomiting following etherization are greatly reduced.

For calling to our attention the advantages of this method of anæsthesia, we are indebted to the kindness of Dr McBurney, of the Roosevelt Hospital.

The apparatus required for the administration of nitrous oxide and ether consists of—

(1) A nitrous oxide tank, bag, and inhaler. The tank holds 100 or 450 gallons of liquefied gas, and can be refilled. The bag holds seven gallons, which is sufficient for one anæsthesia. The inhaler is so arranged with valves that the patient breathes either gas or air, at the will of the anæsthetist.

(2) A closed inhaler of the Ormsby type or an open cone made from a newspaper and towel. The Ormsby inhaler consists of a rubber bag and mouth-piece, connected by a short metallic tube. A small sponge moistened with ether is placed inside the tube, through which the patient breathes back and forth into the bag.

Against the saving of ether and slightly more rapid etherization, brought about by this arrangement, are to be placed, the first cost of the inhaler, the difficulty of keeping the apparatus clean, and the addition of partial or total asphyxiation to the dangers of etherization.

The gas- and ether-inhalers have been combined in one piece of apparatus, but it is cumbersome, expensive, and has all the disadvantages of the closed method.

The open cone is made of a newspaper, folded so as to have twenty layers, six by sixteen inches, and covered by a towel. This is folded and pinned to form a cylinder six inches in height, which, when flattened out, has a long diameter of

six or seven inches. Both ends are left open. In one is lightly packed a wad of absorbent gauze, secured by a safety-pin. The other end is fitted closely to the patient's face. Ether can be poured on the distal end of the cone, which seldom needs to be removed from the face. The patient breathes fresh air charged with ether-vapor, to a greater or less degree, in proportion to the amount poured on the gauze. Such a cone is safe, clean, inexpensive, and easily obtained.

As far as we can learn, everywhere, except at the Rhode Island Hospital, the gas-ether combination is administered by one of the closed inhalers. Our early cases were etherized with an Ormsby inhaler. In June, 1899, we first used gas-ether with an open cone. The result was so gratifying that this method has been adopted as the routine anæsthetic.

The advantages of gas-ether with an open cone over the closed method are—

(1) Increased safety. Cyanosis and danger of asphyxiation are done away with, and the patient constantly breathes fresh air.

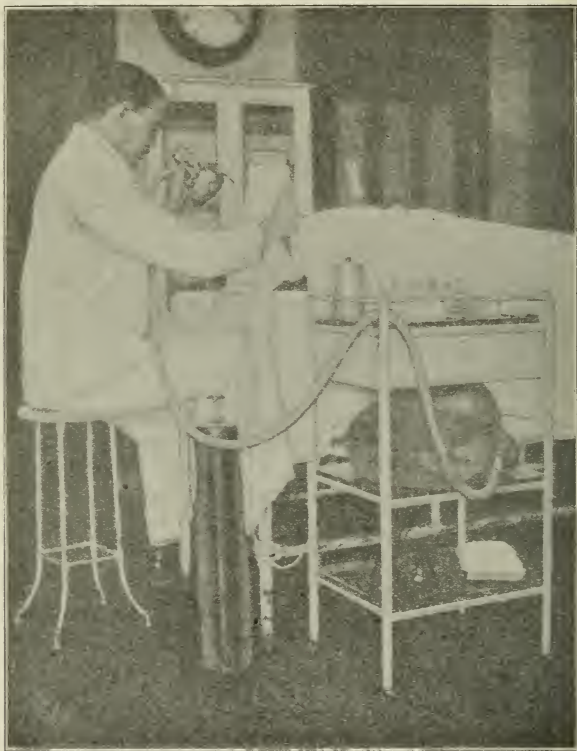
(2) Continuous etherization. As the cone does not need to be removed for this purpose, ether can be administered often and in small quantities.

(3) The cleanliness, simplicity, and lack of expense of the ether-inhaler.

The open method has, also, all the advantages of the gas-ether as commonly given,—viz., rapidity, comfort of the patient, and lack of disagreeable after-effects. The amount of ether consumed is greater than by the closed method; less than in simple etherization. (See illustration.)

The manner of administration is as follows: The nitrous oxide tank, seven-gallon bag, and inhaler being connected, the valve of the tank is opened and the bag fills with gas. On a stand at the anæsthetist's right hand are the ether-can, an open cone placed top downward, and the usual assortment of stimulants, tongue-forceps, and mouth-gag. The patient is instructed to breathe deeply and to hold up one arm. The inhaler, with the air-valve open, is fitted closely over the face. After the patient has taken a few breaths of air through the in-

haler, the valve is depressed, and he begins to breathe nitrous oxide. Within a minute or two the breathing becomes rapid and labored; the pulse, rapid and full; the arm drops; there



Nitrous oxide and ether anæsthesia by the open method.

may be slight cyanosis. The nitrous oxide anæsthesia is complete. The stage of stertorous respiration, muscular rigidity or convulsions, need not be reached.

While the gas is being administered, the anæsthetist has

poured into the ether-cone an ounce or two of ether, and as soon as the gas anæsthesia is complete, the inhaler is removed and rapidly replaced by the ether-cone. Respiration may go on quietly or there may be a brief respiratory struggle; but in a few seconds the patient is breathing quietly and more slowly; the pulse is diminished in frequency; the slight cyanosis has disappeared; the muscles are relaxed, and the conjunctival reflex (obtained by pulling up the lid and not by touching the cornea) is lost. The whole proceeding has taken about two minutes.

While in a large proportion of cases the change from gas to ether is made with no difficulty, there sometimes is considerable struggling; but in the series of 160 cases, of which we have notes, no one has been conscious when the change was made or has experienced anything disagreeable from the anæsthetic. The exact moment when the change from gas to ether should be made is largely to be learned from experience. If too much gas is given, respiration ceases, and it is necessary to remove the inhaler entirely until it returns. If the gas is taken off too soon, the liability to respiratory and general struggling is increased.

The average time required for anæsthesia in our set of cases has been 3.05 minutes. In a series of thirty cases by our anæsthetist it was 2.17 minutes. The shortest time for an adult has been fifty seconds.

During the operation small quantities of ether are poured on the distal end of the cone as often as necessary. The patient, with head turned to one side, breathing the normal quantity of fresh air through the cone, can be kept anæsthetized almost indefinitely, with pupils not dilated, without stertorous breathing, and with seldom any indication for pulling the jaw forward or swabbing out the mouth. There is less change in the conditions to which the body is normally subject than results from any other form of anæsthesia. Since the operation has not been commenced with suffering and terror during anæsthetization, it is not necessary to combat the effects which these sensations would have produced on the nervous system of the patient.

The reduction in nausea and vomiting following etherization has been noticed and commented on by nurses, who did not know of the change in anæsthetics that had been made. Our records show that 46 per cent. of the patients have experienced nothing unpleasant in anæsthesia or recovery; 84 per cent. have not vomited at all; 11 per cent. have vomited slightly; 5 per cent. have been nauseated and have vomited considerably. When placed beside statistics of recovery from ether anæsthesia these figures are very gratifying. Among children, gas-ether works especially well, superseding chloroform in many cases where that would be preferred to ether alone.

Finally, in the considerations of safety and comfort of the patient and saving of the time of the surgeon, we find in the combination of nitrous oxide and ether, when administered by the open method, the nearest approach to an ideal anæsthetic that has been produced.

NOTE ON THE OPERATIVE RELIEF OF ECTOPIA VESICÆ.

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My attention has been lately directed to this condition, on account of a young patient, aged eight months, suffering from the unfortunate effects of this form of defective development, and, on reviewing the literature of its surgical treatment, one is led to the conclusion that an ideal operation has not yet been devised for ectopia vesicæ. There have been two lines of operative treatment pursued,—one, plastic, covering the exposed posterior wall of the bladder by means of skin-flaps; the other, placing the urinary receptacle deeper in the pelvis, either by diverting the urinary passages or by approximating the innominate bones.

In the case of the Trendelenburg operation,—approximation of the bones,—or that of König,—osteotomy of the pubic bones,—the urine being in contact with the line of junction of the symphysis, will necessarily interfere with union. Added to this there is the probability in the female of a resulting deformity of the pelvis. In the operation for diverting the urinary channels towards the rectum, the great objection is, the possible infection of the kidney from ascending ureteritis, besides which the urine is, as a rule, an irritant to the rectal mucous membrane. To overcome this possible infection Maydl transplanted the bladder and ureters intact into the rectum, the expectation being that the oblique entrance to the ureter would here act as a valve in the normal bladder, but the rectum would not contain sufficient urine to mechanically compress

the ureter entrance, and hence, Fowler devised a special valve—a tongue-like projection—which may be a success, but there have not been a sufficient number of successful cases of this operation reported as yet, to allow one to judge (*ANNALS OF SURGERY*, April, 1899).

Gersuny converted the rectal pouch into a receptacle for urine only, by making an artificial anus and shutting off the upper end of the rectum entirely. Besides the dangers mentioned as objections to these transplanting operations, there is the important fact that they all necessitate the total extirpation of the bladder. In the plastic operation, on the other hand, the bladder is retained, and an attempt is made to cover up the defect by a flap, generally of skin. Ayers, of New York (1858), and Pancoast, of Philadelphia (1859), first used the flap method in America, and since then many modifications of this method have been proposed, as Wood (1887), by whom an upper flap was reversed and placed with its skin surface towards the bladder, the raw surface being covered by means of two lateral flaps. (An improvement in the technique of this was devised by De Forest Willard,—*Philadelphia Academy of Surgery*, 1898.)

Thiersch used granulating flaps, and Rutkowski (*ANNALS OF SURGERY*, 1899), instead of using the skin as a flap, brought down a portion of the intestine, which he had first excised, and, leaving it still to receive its vascular supply through the attached mesentery, sutured it to the edges of the defective bladder. The *rationale* of this latter operation emphasizes the defects that have characterized the flap method all through,—viz., an attempt is made to remedy a defect in a muscular organ by means of tissue, skin, and fascia, which does not possess any contractile muscular action. Again, the presence of hairs in the inturned skin tends to the formation of calcareous deposits; the macerating and irritative effect of the urine induces inflammatory action in the flap, and the absence of any sphincter-like muscle necessitates the constant use of a pad to block the outlet of the built-up bladder. Hence, Rutkowski substituted the muscular structure (bowel) for the skin-flap, but his opera-

tion presupposes a procedure risky, to say the least,—viz., intestinal resection.

In view of these varied objections to the present status of reparative surgery of the exstrophied bladder, it seems to me that the possibility of replacing the skin-flap of Wood, or the bowel-flap of Rutkowski, with a flap of normal bladder tissue, if it could be carried out, would be preferable, and with this object in view, I undertook some experiments on animals, to ascertain whether it was feasible to transplant the bladder of one animal into the body of another. These experiments were successful. The method was as under :

“Opening the body of one animal (a dog), I removed a piece of the bladder wall and placed it in warm boracic solution, and made a straight incision in the abdominal fascia of another animal (both being on the operating table at the same time), and down to the deep layer of superficial fascia. I separated these two layers,—viz., the deep and the superficial of the superficial fascia,—and transferred the exsected bladder wall to this space membrane downward, interposing a sheet of gold foil between the membrane and the deep layer of superficial fascia, the object being to prevent union of this surface with the subjacent tissue, and the gold foil and bladder tissue were sutured to the integument and fascia by means of catgut.” The results were perfectly satisfactory, and demonstrated that it was possible to transplant bladder tissue to the superficial fascia.

In view of the above results, it seems to me that one is justified in suggesting the following procedure in ectopia vesicæ :

“Transplant a portion of bladder wall of, say, a sheep, to the lower lateral abdominal fascia of the patient. After a period of seven or eight days, the union of the two tissues is sufficiently strong to allow a plastic operation, whereby a skin-flap with the bladder attached may be swung over upon the extruded bladder, and the edges of the attached piece of bladder sutured to the defective bladder.”

The skin-flap will afford sufficient nourishment to the exsected bladder until union has occurred between the bladder edges, then the superimposed skin may be separated from the now perfect bladder. By employing a transplanted piece, which

has been removed from the lower portion of the bladder of the animal, the aggregation of the circular muscular fibres will approach very nearly to an ideal sphincter. I would suggest seven or eight days for the union of the transplanted bladder to the fascia, since we know that the fate of most transplanted tissues is to lose their normal structure, and become converted into connective tissue. In one case in which I left the transplanted piece in the tissues twenty-four days, the histological structure was almost lost, as seen in the accompanying report of Dr. W. T. Connell.

"Serous coat has become completely vascularized, and from it a small number of vessels pass into the muscular coat. This layer everywhere shows the outlines of the muscular fibres, but these are in all stages of degeneration. The mucous coat is also vascularized, the mucous membrane as such having disappeared, and being replaced by vascular granulation tissue. The epithelium has completely degenerated. The vascularization has occurred over the edges of the gold foil."

Even though some slight changes do occur in the transplanted bladder, in the eight days mentioned above, yet I believe the new vascular supply from the defective bladder, as well as the stimulating action of the urine in the exposed membranes, would prevent any further connective-tissue changes. Should, however, there be no union of nerve-fibres sufficient to allow the muscular tissues of the transplanted piece to become of service, there would still be a decided gain in having a bladder formed entirely of bladder tissue covered with mucous membrane and lined with bladder epithelium.

PERSISTENT THYRO-GLOSSAL DUCT.

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PERSISTENCE of any portion of the thyro-glossal duct seems to be very uncommon. There is not much literature on the subject. The patient in whom I observed this condition was a boy six years of age. Nothing unusual had been noticed until about a year before I operated, when his mother found a small lump, the size of a pea, situated in the middle line of the front of the neck, about three centimetres below the hyoid bone. It gradually increased in size, and in twelve months was as large as a filbert. Subsequently the cutaneous covering became red and inflamed.

When I first examined the boy this lump, covered by reddened integument, was quite conspicuous, and seemed to be irritated by the collar-button. The boy complained that it hurt him.

Another striking peculiarity about the thing was that whenever the boy swallowed the lump was drawn upward distinctly, and also inward and backward, the surrounding skin being thrown forward into a circular fold around the margin of this little red tumor. This had been noticed for about a month, and is no doubt secondary to an adhesive inflammation between the cyst wall and the overlying skin. On palpation a well-defined, hard cord could be felt extending from the tumor to the centre of the lower border of the hyoid bone. The tumor itself was soft and fluctuating. What the nature and pathology of this most unusual condition were I did not know. I ransacked many books without obtaining any light,

and had about decided that I never should be enlightened as to what it was. I have since found the condition described by Bevan in Park's Surgery and in Morris's Anatomy. In the mean time I made a small incision, and with a Volkmann's spoon scraped it out very thoroughly. The contents were not purulent, but of a thick gelatinous character, turbid, like colloid substance. Soon after this I came upon the very thing in one of the Goulstonian Lectures, on the Pathology of the Thyroid Gland, delivered before the Royal College of Physicians of London, by Professor George R. Murray, and published in the *British Medical Journal*, March 11, 1899. In speaking of the *development* and *structure* of the thyroid gland he says, "The gland is developed in the embryo, in three different parts. A median diverticulum of the hypoblast, which lines the pharynx of the embryo, is formed between the ventral ends of the second visceral arches, while a lateral diverticulum is developed on each side from the posterior wall of the fourth visceral cleft. In man the median portion persists for a time as a hollow vesicle, from which a small canal, the thyro-glossal duct, leads to an opening on the dorsal surface of the tongue. At a later stage this vesicle becomes solid, and the duct disappears, while its external opening, on the surface of the tongue, persists as the foramen cæcum in the adult." A little further on, in the same lecture, occurs the following: "He has found that in some cases the thyro-glossal duct already mentioned does not become obliterated, but that it persists in the adult as the lingual duct, which has been traced from the foramen cæcum as far down as the hyoid bone. In some cases the middle lobe of the thyroid is continued upward as a narrow tube, the *thyroid duct*, as far as the hyoid bone."

The late Professor Kanthack, who examined a hundred adults for these ducts, however, found neither a lingual nor a thyroid duct in any of the cases which he investigated, and in many there was not even a foramen cæcum.

After reading this article I hunted up my boy, and found that the cyst had refilled, and that the condition was the same as before operation. At the second operation, on the 17th of

April, 1899, I opened and emptied the cyst, and found that I could pass a fine silver probe along the duct up to the hyoid bone. With this as a guide, I dissected out the duct as well as the cyst wall. Primary healing occurred, and there is now no sign of recurrence. The duct measured three centimetres in length, and was the size of a small lead-pencil.

ACTINOMYCOSIS IN MAN, WITH SPECIAL
REFERENCE TO THE CASES WHICH
HAVE BEEN OBSERVED IN
AMERICA.

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(Concluded from page 631.)

Skin.—Infection of the skin primarily is of rather rare occurrence. There are, however, many interesting cases on record. Our knowledge of the different forms of skin lesions in actinomycosis is due largely to the labors of Leser, who, in a classic article in the *Archiv für Chirurgie*, in 1889, gave his experience in three cases. His conclusions and his account of the cases are so instructive that I cannot refrain from abstracting them.

He states that he examined three cases, and the first would have been passed over for a tubercular lesion had he not made a microscopic examination as a routine procedure. Had he not recognized the nature of the disease in this first case, he would not have suspected the nature of the disease in the other two.

The first case which had been previously diagnosed as tuberculosis was on the dorsal surface of the left forearm, in a male. There was no apparent cause. There was an inflammatory process causing an exfoliation, and then an ulceration, increasing to about the size of a dollar; there were frequent hæmorrhages, alternating with exfoliation. When seen by the author, there was an ulceration about the size of a

dollar, partly filled with discolored pus, the borders were jagged, and somewhat raised and undermined. There is induration about a finger's breadth around this, and reaching out, there is a string as thick as a pencil under the normal skin. There was a slight pain on pressure. There is a similar place on the right side of the scalp. A cicatrix, the size of a dollar, marked with lines radiating from the centre, at the border of which were found small, bleeding granulations, which seem to be adherent to the skull underneath. There was also in the right infraclavicular region a board-like spot, the size of a five-mark piece, covered with twelve to fifteen tubercles, which are closely placed. These tubercles are the size of a lentil or smaller, and are brownish in color, or bleeding with a rubbed-off appearance. It has the appearance of a true tubercular lupus. Over the left side of the abdomen there is another spot. The diagnosis of skin tuberculosis seemed plain. The microscope proved it to be otherwise. The arm was curetted, and the granulations were harder to remove than in tuberculosis. There remained several bands of lighter tissue which extended along the fascia and the muscles. After cauterization it had the appearance of a sieve. Healing was slow. The other lesions were cut out and sewed up. Healing in these took place slowly. In four months the lesions on the scalp and arm had returned. The lesion on the scalp had extended in size to that of a small plate (*Hand-teller*). It had also extended into the bone. On the surface of the skull were small osteophytes, which were chiselled off. The diploë was also involved. After two removals permanent healing took place; this was two and a half months later.

The second case is no less striking than the first, although it is of an entirely different type. The patient was a man of thirty-four, who, six days previous to examination, noticed a swelling in the right calf. This was attended with severe pain. It increased rapidly, and was attended with constitutional symptoms.

Three days before being seen he had a chill followed by a fever (39.4° C.). Patient, on entry to the clinic, was very much excited and appeared as if drunk. The right calf was

swollen to the extent of two small plates (*zwei hand-teller*) and was very painful to the touch. There was no trace of external injury of the skin. There was indefinite fluctuation and a board-like hardness of slight extent. In three hours' time it had extended two and a half fingers' breadth. There was no glandular enlargement. It was opened, and found to contain yellow-gray pus in the connective tissue. There were four openings in the fascia, through which it had extended into the muscles. After thorough curetting and cauterization, followed by two returns, it healed, taking two months' time.

The third case was first thought to be a syphilitic lesion. In all the cases the actinomyces was demonstrated, although it sometimes required very careful searching over many specimens. In some cases the streptothrix was found in what appeared to be normal skin, and this fact accounts for the returns after apparently very complete removal.

Leser concludes that there are two forms of the disease in the skin, (*a*) an ulcerating form, where there is a partially necrotic part and a partially hard, firm, granular part. This form is an actively productive process. (*b*) A discrete tubercular (nodular) skin inflammation, with central cicatrization and peripheral extension, like in lupus. The two forms may occur together. It may be chronic, subacute, or acute, and may be attended with marked general symptoms.

Leser also expresses the opinion that it is possible that the cases of lupus, where the tubercle bacillus is not found, may be actinomycotic in their nature. He also remarks that the absence of involvement of the lymphatics is an almost pathognomonic sign, in the majority of cases. This may occur in cases of actinomycosis where secondary infections have taken place. The board-like induration and the grossly nodular condition are not usual in other conditions.

There have been other interesting cases of cutaneous actinomycosis. The mode of infection is worth inquiring into. In Hudson and Flexner's case the skin of the back was infected while sleeping on the straw and hay in a stable. In Nocard's case the patient had been kicked by a horse several times. In one of Hochenegg's cases a young girl infected a suppurating

wen on the cheek while sleeping in the stable. Partsch (*Deutsche Zeitschrift für Chirurgie*, Band xxiii) reports a case where, following the removal of a suppurating cancerous breast, there was subsequent involvement of the cicatrix by actinomycosis.

Kaposi (*Wiener medizinische Wochenschrift*, 1887) reports a most unusual case of skin invasion over the pectoral muscle; nodules kept on appearing in different parts of the body for eleven years.

Norman Walker (*International Clinics*, 1897, Vol. ii, p. 252) says that actinomycosis of the face may be mistaken for rodent ulcer. The differential diagnosis being made on the fact that in actinomycosis there are small bleb-like granulations, and also the presence of the parasite.

The following cases are interesting in this connection. In the first case it is doubtful through what channel infection took place.

CASE LVII.—H. B. McIntire (*Boston Medical and Surgical Journal*, 1897, cxxxvi, pp. 84-86). White male, fifty-one years of age. Seat of infection: Subcutaneous (?). Illness began with a failure of general health. Pain noted in the epigastric region extending to the left. Respiratory movements on the left side restricted. Pitting on pressure over a swollen area; in front, in the region of the eighth and ninth ribs, extending to the nipple. No redness over this area. The swelling was outside the ribs and had a peculiar feeling of firmness, as though it was bound down firmly. There was no cough and but slight elevation of temperature. Two weeks later there was a boggy place, about the size of a half dollar. On opening, two days later, the cavity was found one and a half inches below the surface, and it was about one by two inches in extent. It was filled with a grayish, granular, cheesy mass. Some days later the discharge on the dressings had yellowish granules in it. These were thought to be due to the iodoform, but they were found to continue on the use of plain gauze.

Four weeks later there was an area of dulness over the back and a similar invasion over the twelfth rib. These were not opened until later, when they were found to contain the characteristic granules. One month later, after a spell of coughing, lasting several hours,

patient expectorated some eight or ten ounces of sputum. After this the cough ceased. This expectoration did not contain any sulphur granules. Granules also subsequently disappeared from the anterior opening, and it healed. Posterior sore continually kept changing its position. There was no fungus found at any time in the sputum.

Operation.—Incision the whole length of the cavity and curetting of the area.

Medical Treatment.—Iodide of potassium, grains eight t.i.d.; raised to ninety grains.

Result.—Death six months later.

Diagnosis made some days after operation, on seeing the sulphur granules. No autopsy. Residence, Cambridge, Mass.

CASE LVIII.—A. Schirmer (*Chicago Medical Journal and Examiner*, 1886, liii, p. 351). Patient was a white male, laborer, aged twenty-one. Infection occurred through a subcutaneous wound, which was sustained while the patient was chopping wood. Swelling occurred on both sides of the chin underneath. Swelling persisted on the right side. He consulted a physician on account of the pain. A fistula formed after the injection of a clear fluid (?) subcutaneously. The patient became unable to open his mouth. The neck became stiff and the patient unable to move it. The pulse was quickened and the temperature elevated. He had a slight cough. The abscess was opened and the fistulæ scraped out, but the patient grew worse. The organism was found in the sputum. Residence, Chicago.

Dr. Schirmer has since informed me that the patient died.

CASE LIX.—W. H. Hudson and Simon Flexner (*ANNALS OF SURGERY*, 1897, 621). Patient was a male, negro, aged sixty-two. He had been a stableman, and was in the habit of taking naps lying on the hay or straw. Had a "running sore" over right scapula. Eighteen years before had a small tumor on the same spot, which had been cured by the local application of tincture of iodine. Sore was treated by local applications of bichloride of mercury externally and by the administration of iodide of potassium internally. Grew better and then worse. Disease extended to the right side of the spine and also to the left, but to a lesser extent. No fever, anæmia, pulse good, no chills, and no cough. Skin and subcutaneous tissue indurated and perceptibly thickened. Scraped out after finding the actinomyces, but this was not very thoroughly done, owing to the loss of blood. The following year began to cough, and the actinomycetes were

found in the expectoration from the first. Had slight fever and a great deal of pain. External wound continued to discharge. Death took place a year and a half after first seen.

Autopsy.—Right lung extensively and the left less diseased. Parasites in the alveoli, and in groups of two or three of the adjacent alveoli. These are surrounded by polymorphonuclear leucocytes which fill the spaces. Residence, Lafayette, Ala.

In the following case it looks as if the infection might have been caused by the sutures used. One is rather inclined to believe, however, that the case is one of intestinal infection, and that the occurrence immediately after the operation was a mere coincidence.

CASE LX.—Alexander H. Ferguson (referred to in the same meeting as McArthur's case). Patient was operated on for hernia, using catgut sutures. The wound did well until the third week, when a small sinus appeared. Three weeks after that there was a well-developed mass of actinomycotic tissue. A second operation was done to remove this. When the abdomen was opened there was found to be involvement of omentum and the intestines. Patient recovered from the operation and went to the almshouse, and died there. Iodide of potassium was administered internally. Residence, Chicago.

The following case is of interest inasmuch as it is the only reported case in this country where the breast has been the site of the lesion. The original involvement was not, I am sure, in the gland tissue, but for clinical purposes it may be classed as a case of actinomycosis of the breast, and the occurrence should be borne in mind in considering the diseases of that organ. A number of such cases have been reported by European observers.

The case was mentioned by Dr. McArthur at a meeting of one of the Chicago societies, and reported in the *American Journal of Gynecology and Obstetrics* (1897, p. 364) as a case which recovered. The subsequent history of the case and the full notes of the same were sent me through the kindness of

Dr. McArthur, and this is practically the first publication of the case in full.

CASE LXI.—Patient was a clerk, aged twenty-two. She entered the hospital November 16, 1896, complaining of a painful nodule under the upper border of the left breast. Family and previous history good, except that she had, one year prior to admission, what was supposed to be a pleurisy on the left side. It was very painful, but not accompanied by any effusion nor by marked fever. She has always lived in the city.

Eight weeks before entrance the patient noticed a small, hard mass in the upper part of the left mammary region, measuring about one inch in diameter, hemispherical, free from pain, and but slightly tender on pressure. A small portion of the growth was removed for diagnostic purposes. Microscopic examination proved it to be normal mammary-gland tissue. The wound healed by first intention. Four weeks later a small sinus formed below the site of the incision; the discharge was thick and yellow, and at times mixed with blood. A circular incision was made about the left breast, exposing the pectoralis major and minor, and reflecting back the mammary gland. The latter muscles, as well as the chest wall beneath, were softened, necrotic, of a dirty chocolate-brown color, containing very minute yellow granules, which proved to be actinomycetes. The walls of the sinuses were curetted, cauterized with 95 per cent. carbolic acid, and packed with gauze. Three weeks later a secondary operation was performed, the infection having spread towards the axillary region, under the gland. This was almost dissected off the chest, being left to be nourished by its upper and outer edges. The sinuses were again curetted well up into the axilla, and the wound left to heal by granulation. Since that time numerous subcutaneous sinuses have appeared at different margins of the wound, the discharges always containing the sulphur granules. Said sinuses were always laid open to their utmost extremity, and packed with iodoform gauze after cauterizing with carbolic acid. Two months after the entrance into the hospital the wound appeared perfectly healthy. After that sinuses appeared from time to time, always discharging sulphur granules. Some of these led to beneath the fourth and fifth ribs, necessitating resection of portions of them. They showed the characteristic caries produced by the organism. One sinus led towards the middle of the sternum downward. It was curetted thoroughly.

One year later, the patient having been in the hospital over a year, she was discharged by the authorities as incurable. At this time she was much improved physically, but sinuses persisted, recurring from time to time, being healed in the interims. She had been using local applications of equal parts of iodine, carbolic acid, and glycerin, and taking iodide of potassium internally.

She entered another hospital, where another extensive operation was done, ribs being resected and sinuses scraped out. The lung-tissue was not involved apparently, but the patient developed a cough and had expectoration tinged with blood. No organisms were found in the sputum. The wound healed with the persistence of the sinuses. Patient left and went to her home.

Three months later was seen at her home, and she was found to be greatly emaciated, with high fever, and a foul-smelling wound infected with the bacillus pyocyaneus. Extremities swollen, œdematous, and over the soles of the feet and the palms of the hands were found small, dark-reddish, painful nodules, which contained chocolate-colored pus on opening, but no visible granules. Over her body and scattered over the thighs and arms were small nodes which could be felt, but the pigment did not show through the skin. These were painful on pressure and ultimately opened as abscesses. She died a month later.

Bone Involvement.—The skeleton may be the seat of extensions. The sternum, the ribs, and the spinal column have all been affected. The spinal column is the favorite site of bone lesions. There have been a number of cases reported where there was involvement of the bodies of the vertebræ, together with the destruction of the articulations and the ligaments, so that the cases resembled Pott's disease. Such cases have been reported by Langenbeck, Boström, Netter, Ponfick, and others. More generally the lesions remain prevertebral, and there is not the deformity nor "hunch-back." In one or two cases (Poncet and Soltman) there have been lesions in the spinal meninges with involvement of the cord. Other facts about the bone involvement are given with the consideration of the disease in the jaw.

Pseudo-Actinomycosis.—Under this heading may be considered those diseases in which the lesions resemble actinomy-

cosis, and the cause is a parasite resembling the actinomyces. These concern the clinical laboratory worker more than they do the clinician himself. They bear the same relation to actinomycosis that pseudo-tubercular processes bear to tuberculosis.

They concern principally the lesions that occur about the mouth and respiratory tract. They include as causal factors the aspergillus niger (Wheaton), the leptothrix (Affanasjeff and Coppen Jones), the cladothrices, and the other parasites of the mouth and the pharynx.

The diagnosis in the laboratory presents little difficulty. The culture methods are conclusive, but staining with Gram's method, and direct examination will generally suffice. The leptothrix threads are longer, thicker, and have not the appearance of ramification seen in the actinomyces. The cladothrix has no true ramification, but branches off from the thread. The cladothrix has a sheath, and the ramified cladothrix is a mass of individuals, a zooglœa mass, the streptothrix actinomycotica and its branches are an individual (Cohn).

There are a number of actinomycetes, or oospora, as Sauvageau and Radais have proposed to call them, which are very much like the streptothrix actinomycotica (or actinomyces bovis). Blanchard ("Traité de pathologie générale de Bouchard," ii) recognizes twelve species, eight of which are pathogenic.

The oospora (streptothrix) asreoides, discovered in 1890 by Eppinger in an abscess of the neck in a fatal case of meningitis, is of interest as bearing on human pathology. It has been found several times in man, in an inflammatory process near the great trochanter, in a pulmonary complication of a subcutaneous abscess, etc. It differs from the streptothrix actinomycotica in growing only on neutral or slightly alkaline media, while the streptothrix actinomycotica grows on acid media very well.

Madura Foot Disease.—This disease, described for the first time in 1712, and named in 1862 by Carter, is more like true actinomycosis than any of the other pseudo-actinomycoses. It occurs most frequently in India, where it is not uncommon, but

cases have been described in Europe and South America. Four cases have been reported in the United States.

As it is very liable to be mistaken for actinomycosis, a short description will not be out of place. It occurs, as the name would indicate, most frequently in the foot. The proportion of foot infections to those of other parts of the body is about 80 per cent. for the feet, against 20 per cent. for the other parts of the body. Next to the feet the hands are most frequently affected. It comes on insidiously, the patients not generally applying to the physician until the disease has reached the fistulous stage. It first starts as a swelling of the subcutaneous tissues, most frequently about the heel, although it may start anywhere on the foot. This swelling is soon attended with the formation of nodules of varying size, from that of a pea to a small nut. At this stage there is but little pain; later, as these nodules soften and break down, there is pain. On breaking down the nodules leave small suppurating fistulæ, which discharge the organism in granules much like those of actinomycosis. The lesions are usually limited to the subcutaneous tissue, and there is little tendency to form metastases. There is, however, frequent involvement of the lymph-glands, a thing that seldom occurs in true actinomycosis. There is also an atrophy of the muscles of the legs (when the lesion is in the foot). The prognosis is bad. An amputation is generally required. The patients dying generally from exhaustion if the diseased tissue is not removed.

The organism causing this disease is a streptothrix (*oospora maduræ*), and differs but slightly from the streptothrix actinomycotica. The grains are either yellow or black. The yellow grains are the most frequent, being found in about four-fifths of the cases (Kanthack). The yellow grains are never found in a case where the black grains occur, and *vice versa*. (One recalls in this connection the case of Langhans, where, in a patient with actinomycotic lesions in his liver, the grains were black in color.) The grains of either color are generally larger than the granules of streptothrix actinomycotica. They may be massed together until they are the size

of a pea. They fragment easily. The organism grows in the ordinary media.

The streptothrix, which causes *farcin de bœuf*, resembles the streptothrix actinomycotica, but this has not yet been found in man.

Under the heading of pseudo-actinomyces there has been described an organism which resembles the above very closely. This organism was simultaneously described by Mosetig-Moorhof (*Wiener medizinische Presse*, 1895, cited by Poncet and Bérard) and Poncet and Dor (*Gazette hebdomadaire*, 1896). The clinical history of these cases was much that of actinomycosis.

The disease affected the cheek in two cases, the lung in one, and the tissues of the neck above the hyoid bone in one. The organism resembled the streptothrix actinomycotica in most particulars, but were fewer in number, larger, more friable; the appearance under the microscope was that of an organism having some of its elements, thinner and longer than streptothrix actinomycotica, and some of them shorter and thicker. There were no clubbed ends. In the bouillon cultures the fluid was made turbid, and had a fetid odor after several days, both things being absent in the true actinomyces.

T. G. Savchenko, in the Russian *Archives for Bacteriology and Pathology* (*Lancet*, 1896), describes a case of a similar nature. The lesions were in the thorax. The organism was much like the preceding, but did not stain by Gram's method, and the elements more short. It may be classed as a streptothrix. He suggested the name of bacillary pseudo-actinomycosis for the affection.

The disease of horses and sheep, a papillomatous growth following castration and due to a staphylococcus, known as botryomycosis, has been described in man, and as the organism that causes it forms yellow grains, it deserves mention. It is very rare, and I do not know of its occurrence in man in this country. It can readily be distinguished under the microscope, and the lesion resembles a papilloma very closely.

In this connection may be mentioned also the fact that of late a number of observations on the tubercle bacillus tend to

the formation of an opinion that it may be more closely related to the streptothrices than we have hitherto supposed. As early as 1885 Babes noticed the ramifications and swellings in old cultures. This was also noted by Nocard and Roux in cultures of avian tuberculosis, grown at a high temperature. Metschnikoff, in his lectures at the Institut Pasteur, mentioned the fact that the tubercle bacillus branches under certain circumstances, and Babes called attention to the fact that the crosses observed in the tubercle bacillus are the terminal branches of a streptothrix.

Friedreich, of Leipsic, in the *Deutsche medicinische Wochenschrift*, October, 1897, describes his experiments where the tubercle bacillus was injected into veins. In the successful inoculations there were in the lungs, kidneys, and the iris appearances strikingly like actinomycosis. The bacilli were in clumps, tangled together, and with some clubbed ends. This has been casually noted by other observers. In this connection we recall the fact that as early as 1889 Fedor A. Lösch described a condition that he noted in seven out of thirty-seven cases where he had made microscopic examinations. In six of these cases there were also found tubercle bacilli. In these cases he found peculiar, colorless, pale-yellowish granules resembling actinomycotic granules, both in appearance and also in chemical reaction.

The difference, however, was very plain when they were crushed between two cover-slips. When so treated, and examined with a microscope, they are found to be made up of granular detritus. These observations were published in the *Transactions of the Third General Congress of Russian Medical Men*, St. Petersburg, 1889. Professor Affanasieff, of St. Petersburg, accepted the principal part of the paper. (See *Medical News*, Philadelphia, 1889, p. 242.)

Secondary Infection.—These are important, from the fact that metastases are more apt to occur in those cases where they are present, on account of the fact that the additional organisms often cause ulceration through the walls of the vessels, and so make a way for the actinomycetes. These cases are the ones which resist the use of iodides, and they are also more likely to

be extensive in their character. The organisms usually found are the streptococcus pyogenes and the staphylococci, and in the lesions about the mouth the common mouth bacteria.

Diagnosis.—The diagnosis of actinomycosis cannot be made without either finding the actinomycetes in sulphur granules or in sections, or the characteristic tissue-changes in sections. The latter should never be relied on by any except a professional pathologist of most unquestionable ability, and even then should serve only as an incentive to further efforts to find the organism. It rarely happens that it cannot be demonstrated if a sufficient number of specimens of pus or sections of the tissue are examined. The organism can be demonstrated in the sputum in cases of pulmonary actinomycosis in the greater proportion of the cases. It has been found in the stools. All discharges and all pus containing granules should suggest the disease, and a careful examination made. The following list of what granules may be found is of use :

- (1) Actinomycetes.
- (2) Pseudo-actinomycetes.
- (3) Mycetoma of Madura foot disease.
- (4) Crystals of Leucine (Lösch).
- (5) Elastic fibres and cellular *débris* (Coppin Jones).
- (6) Masses of the leptothrix buccalis (Hodenpyl).
- (7) Masses from suppurating cancer.
- (8) A number of other things which Poncet and Bérard have summed up as follows :

"In the pus, whatever may be its origin, there are nearly always present granules which may be mistaken for actinomycetes, such as that from alveo-dental periostitides, where the buccal concretions (food tartar, etc.) are added to the mucus-like products of the fistulæ; such as the abscesses connected with bone, where there are small sequestræ and more or less grumous caseous masses; and, finally, the suppurations of ulcerating cancers, cutaneous or deep, especially the sebaceous epithelioma with multiple nodules, and the suppuration of old cystic tumors, and in the course of degenerations, such as that of old goitres with calcareous cysts, dermoid cysts, wens, etc."

Most of the above may be dismissed with the remark that a careful microscopic examination will make the diagnosis plain. In the case of the *leptothrix buccalis* the clumps usually have an epithelial cell in them, as pointed out by Hodenpyl. The differential diagnosis between the *leptothrices* and the *streptothrices* (*actinomycetes*) is mentioned elsewhere.

The disease may resemble two types of affections,—inflammations and new growths. It differs from most (not all) of these in that there is never involvement of the neighboring lymphatic glands. This is a point second only in importance to the sulphur granules.

In the temporo-maxillary forms the diagnosis lies between the periostitis of dental troubles and tumors, and tumors of the temporal and parotid region. In the first case the freedom from involvement of the skin, the absence of trismus, the absence of involvement of the muscles are all points of interest. The eruption of the wisdom-tooth may lead to some difficulty, as there is sometimes a small amount of trismus connected with this event. Rouffiandis ("Thèse de Lyon," 1896, cited by Poncet) has reported a case of tumor of the lip that simulated actinomycosis very closely. It proved to be a case of epithelioma, with the formation of numerous pearls which were mistaken for sulphur granules. The microscope revealed the difference.

The forms occurring in the mouth must be distinguished from chancroids, gummas, and epitheliomatous conditions. In these cases, in examining the secretions, it is important to bear in mind that the *leptothrices* found in the mouth may resemble the *actinomycetes* very closely.

In the forms involving the tissues below this Ludwig's angina, tumors, simple phlegmons, cold abscesses must be borne in mind.

The osseous and periosteal forms must be distinguished from sarcomas of the bone, cysts, and syphilitic affections. There are not many guiding points here, but it will be remembered that actinomycosis is most frequent in adult life, while cysts and sarcomas are most frequent in childhood and ado-

lescence. The disease may resemble an acute osteomyelitis. Senn quotes a case of Kapper, of a young soldier, of twenty-two years, who was taken suddenly ill with febrile symptoms together with rapid swelling of the jaw. An early incision revealed pus, which contained sulphur granules.

The diagnosis of the thoracic forms of the disease must rest upon finding the sulphur granules in the sputum, or if sinuses exist in the discharged pus, or in the pleural exudate, if it is present. The disease may be confused with the various forms of tuberculosis, syphilitic manifestations of the lung, new growths of the lung, and in the mediastinum, and also with hydatid cysts of the lung or pleura, or with empyemas. There are no distinguishing signs or symptoms. Netter has claimed that there was a board-like œdema of the chest wall in pleural effusions of actinomycotic origin. This has not been found in all cases, however. Hæmorrhage from the lungs is of extremely rare occurrence in actinomycosis.

In the abnormal form of the disease there is little of value beyond the special points already mentioned. In the appendicular form, where there is deep induration, it is apt to be mistaken for cancer of the cæcum or ordinary infection. The cachexia in the cancer of the cæcum might be a feeble guide. Where it nears the surface there is a bluish violet discoloration of the skin, which is suggestive.

Prognosis.—The progress of the disease varies much with the following factors: The degree, nature, and extent of the lesions; the initial virulence; and the presence or absence of secondary infections.

As regards the first, it may be said, in a general way, that this as most diseases follows the rule, the danger increasing directly with the size of the lesion and the relative importance of the part affected. There are, however, curious anomalies and cases which have been given up on account of the extent of the lesion have after a time recovered. On the other hand, apparently slight cases have proved fatal in a few weeks. Jirou gives the death-rate of the various forms as follows: Face and neck, 11 per cent.; thoracic, 83 per cent.; abdominal, 71 per cent.; cerebral, 100 per cent.

Where the lesion is small and the case operable, the prognosis is considerably improved. As regards the value of surgical interference Grill's figures may be quoted. In seventy-seven operations there were twenty-two cures, ten improved, and forty-five deaths,—that is to say, there was a favorable outcome in about 35 per cent. of the cases. It must be borne in mind that these figures include all kinds of cases.

Involvement of the liver is always a grave complication. It may be noted in passing that the lung cases are apparently not as amenable to iodide of potassium as the other forms of the disease.

The result in the American cases was as follows: Cured with the use of iodide and surgical procedures, 4; cured, iodide not mentioned, 13 (total, 17),—percentage, 29.29; improved, 4,—percentage, 7.44; unimproved, 2,—percentage, 3.44; unheard of, 8,—percentage, 13.98; died, 27,—percentage, 47.24.

The duration of the disease is very variable, lasting from a few weeks in some to as long as many years. Kaposi's celebrated case extended over thirteen years. The lung cases have an average duration of ten months in the fatal cases.

Treatment.—The treatment of actinomycosis is both surgical and medical. In the earlier cases the former was the only one used; later on, however, it has been found that the course of the disease could in many cases be modified by the use of drugs.

Surgical.—In the cases where the disease is limited in extent and well defined, complete removal is by far the best procedure. After that the area, if the location permits, should be thoroughly cauterized, preferably with the thermocautery. If the disease is not well defined, or if it involves parts whose removal would jeopardize the life of the patient, it is better to resort to the use of applications of antiseptic solutions and to the injections of the same into the diseased tissues. In many cases both of the above methods may be combined with advantage.

The cases about the jaws give good results under the former treatment, as do also the localized cases classed as cutaneous. More than one removal may be necessary, one or more relapses may be regarded as almost the rule. If there is a condition where the treatment is to be persisted in, it is this one.

The thoracic cases do badly, as a rule, no matter what treatment is followed. Cases where there are collections of pus in the pleura should be opened and drained. The extensive abdominal cases do not yield to surgical treatment, though there is no objection to opening the peritoneal cavity to explore and possibly to help the patient. Irrigation with salt solution, like the proceeding in peritoneal tuberculosis, might be tried if the case was a suitable one. Many of the more chronic of the appendix cases have recovered under repeated removals of the diseased part. Care should be taken not to infect the healthy tissue by careless procedures, and to guard against the loss of blood. This last is of particular importance, as in the removal there is apt to be very free bleeding from the diseased parts. The bleeding is singularly hard to control in some cases. I have seen one in which it was almost impossible to stop the extensive oozing.

In the cerebral cases trephining should be tried and drainage allowed. In most cases—no matter what the location—drainage will be found necessary.

Injections.—A number of drugs have been tried, and there is no particular choice. Illich recommends solutions of bichloride of mercury; Volkmann uses boracic acid; Israel prefers the tincture of iodine (see also Duguet, *Presse Médicale*, 1897, No. 39); Geissler and Jaenecke tried chloride of zinc; Bostrom uses carbolic acid and salicylic acid, while others have used nitrate of silver solutions, iodoform, etc. Iodide of potassium solutions and also local applications by means of a stick of the salt have been used by Poncet. Rydygier (*Wiener klinische Wochenschrift*, November, 1895) has also tried the iodide injections. Parenchymatous injections of alcohol have also been tried (*Journal of the American Medical Association*, 1898, Vol. xxx, p. 220).

Cauterization.—For this purpose both the hot iron and the different acids and caustic preparations have been tried. Nitrate of silver has been used with considerable success, and chloride of zinc, too, has been found of service. After a careful study of the result one is inclined to think that more depends on the one who uses the caustic than upon the one selected. Persistence and common-sense judgment being indispensable.

Dressings.—These may be made with whatever antiseptic the surgeon prefers. Iodoform would seem to be one of the best drugs to use. Leith noticed that there was degeneration of the colonies near where it had been used freely. Boström, Illich, and Samter have all recommended it.

Gautier (Darier and Gautier, "Un Cas d'Actinomycose de la Face," *Semaine Médicale*, 1891, p. 245) cured a case by first injecting iodide of potash solution and then passing an electrical current through the tissue.

Biegler used the bacterial proteids from the staphylococcus aureus successfully in a case where the head and neck were affected. Twenty-five injections were required.

Billroth, Ziegler, and others tried tuberculin with apparent success. This treatment, so alluring to the fancy, has been recently commented on as follows by Professor Friedreich (*Deutsche medicinische Wochenschrift*, 1896, Vol. xiv, p. 579: "Tuberculin is not a remedy for actinomycosis; the cures may be attributed to the tendency of the disease to get well. It has no tendency to weaken the virulence of the organism nor to destroy it."

Internal Treatment.—Internally there is one drug which stands far above all others. This is iodide of potassium. The drug, according to Nocard, was first used in this disease by Thomassen, of Utrecht, in 1885 (*Journal of Comparative Pathology and Therapeutics*, June, 1893). He used it in cattle in doses of from six to ten grammes daily. There was a hastening of the elimination of the sulphur granules from the sinuses, and the tumors gradually disappeared. No attention was paid to this discovery until Nocard had verified it and published the method.

In this country in cattle it has been used with considerable success. In 185 cases, in Chicago, seventy-one recovered. In man it was first used by Van Iterson, in Leyden, and by Salzer, in Utrecht (Chretien, *Medical Week*, February 1, 1895). It has been very generally used since then with very good results. Among others who attest its efficacy are Poncet, in France; Pringle, in England; Schon, in Denmark.

In this country its use has been very limited, and no conclusions can be drawn as to its efficacy here, although there is no reason to expect any different results than elsewhere.

Its mode of action is as obscure as in other diseases where it does good. Nocard states that even in 1 per cent. solutions it does not check cultures. Netter believes that it acts by increasing resistance.

It should be given in increasing doses, and given persistently, unless it interferes with digestion too much. Starting with five or ten grains, three times a day, it may be increased to forty or fifty grains, three times a day. Some patients will bear even more than this. In some cases it does not exert any influence whatever.

Ammendorp and Tscherning, of Copenhagen (quoted by Morris), recommend arsenic, both alone and in combination with the iodide. Eve uses bichloride of mercury in combination with the iodide.

Pringle used thyroids in two cases. In one there was rapid improvement, and in the other the administration had to be stopped on account of the bad constitutional effect.

In the pulmonary forms of the disease it is worth while to use oil of eucalyptus, both internally and by inhalation sprays. Butler, in a case which recovered, used it in five-minim doses, every four hours, given in capsules, and he later increased the dose to ten minims.

In the midst of surgical operations and drugs the patient himself should not be forgotten. The best of hygienic surroundings, together with plenty of sunshine, fresh air, and good food, will prove invaluable. The patient, in this as in other diseases, should be studied, and if the iodide does not agree with

him, change the adjuvant or change for a while to iron and a general tonic treatment. Look to the comfort and well-being of the sufferer as well as to the surgical operation.

ADDENDA.

In order to bring all the American cases published up to January, 1899, together to save labor of looking up the many references to future workers on the same subject, the following case is added, though the report is being made after the paper was finished.

CASE LXII.—Guido E. Cagliari (*Pacific Record of Medicine and Surgery*, December 15, 1898). The case was that of a young married woman, aged thirty. At the outset the case presented the appearance of an ordinary lobar pneumonia; resolution began on the tenth day by lysis. About a month after the disease began the following condition was noted: Slight rapidity of breathing with excursions of the left chest more extensive than right; lower half of right thorax more extensive than left. This area hyperæsthetic, vocal fremitus absent, dullness. Over resonant regions breathing puerile, over the dull area breathing is bronchial, and in places there is absence of breath-sounds, but râles are present. Exploring needle revealed pus, but it was impossible to draw it off by aspiration. Resection of ribs with drainage revealed several pockets of pus containing actinomycetes. Patient was put on iodide of potassium and the cavity irrigated with bichloride solutions. Case passed into other hands, diagnosis of lupus vulgaris being made. After two months seen again, and then was very much emaciated, had constant night-sweats and cough, with bloody expectoration. She had about a dozen sinuses over the back and side. Patient died a few weeks later. No autopsy. Residence, California.

Three additional cases have been noted in "Progressive Medicine," by J. C. Da Costa.

This makes the total number of cases reported to that date, in this country, as sixty-two.

CASE LXIII.—(1) Mattress-stuffer; sinuses about neck, which were first thought to be sarcomatous. Given iodide; improved and was lost sight of.

CASE LXIV.—(2) (Dr. Hearne). Stableman. Disease started in the mucous membrane of the cheek. Removed; recurred. Iodide gave no relief.

CASE LXV.—(3) (Dr. Keen). Inner side of arm first affected, afterwards very extensive involvement. Cured after a very severe operation.

LITERATURE.

The literature on actinomycosis is very extensive and is increasing daily. There are very copious lists in the *Gazette des Hôpitaux* for February 29, 1896, and March 7, 1896. The recent work of Poncet and Bérard also contains a long list of references. The following is a partial list used in collecting material for the preceding paper:

Acland: "Actinomycosis Hominis," *Lancet*, 1886, p. 973; *British Medical Journal*, 1886, Vol. i, p. 1159.

Baumgarten: *Jahresbericht über pathologische Anatomie*, 1886.

Bertha: *Wiener medizinische Wochenschrift*, 1888, No. 35.

Billings, J. S.: "A Consideration of Actinomycosis, as to its Nature and its Relation to the Public Health," *Times and Register*, New York and Philadelphia, 1892, Vol. xxiv, p. 484-502.

Billroth, J.: "Some Remarks on Actinomycosis," *Alabama Medical and Surgical Journal*, Birmingham, 1887, Vol. ii, p. 321-329.

Bodamer, G. A.: "Actinomycosis in Man, with a Report of a Case," *Medical News*, Philadelphia, 1889, 230-232.

Bollinger: "Ueber primäre Aktinomykose des Gehirnes bei Menschen," *Münchener medicinische Wochenschrift*, Vol. xxiv, p. 41, 1887; "Ueber eine neue Pilzkrankheit beim Rinde," *Centralblatt für die medicinische Wissenschaft*, November 27, 1877; *Deutsche Zeitschrift für Thier medicin und vergleichende Pathologie*, 1877, Vol. iii.

Boström: "Untersuchungen über die Aktinomykose des Menschen," *Beiträge zur Pathologie und zur allgemeinen Pathologie*, Vol. ix, 1890.

Bristowe and Harley: *St. Thomas's Hospital Reports*, 1884, 1886; *Pathological Society's Transactions*, London, 1885.

Brown, E. L.: "A Case of Actinomycosis," *Chicago Medical Recorder*, 1894, vii, 251.

Bucking: "Actinomycosis," *Chicago Medical Times*, May, 1897.

Butler, Glentworth R.: "Pulmonary Actinomycosis: Recovery under the use of Oil of Eucalyptus," *Medical News*, April 23, 1898, Vol. lxxii, p. 17.

Byron, J. M.: "A Case of Actinomycosis in Man," New York Medical Journal, 1889, Vol. 1, p. 716.

Codman, E. A.: "A Case of Actinomycosis," Boston Medical and Surgical Journal, August 11, 1896, Vol. cxxxix, No. 6.

Crookshank, Edgar: "Actinomycosis and Madura Foot Disease," Lancet, January 2, 1897; Lancet, February, 1889.

Chretien: "Actinomycosis Humaine," Semaine Médicale, Vol. iii, No. 4.

Davaine: "Note sur une Tumeur indetermine des Os maxillaires du Bœuf," Comptus Rendus de la Société de Biologie, 1850, cited by Chretien.

Delore: "Actinomycose Spinocerebral," Gazette hebdomadaire, 1896.

Dor: "Nouvelle mycose grains jaune," Gazette hebdomadaire, June, 1896.

Doria, E. D.: Annali dell' Instituto d'Igiene sper della Univ. di Roma, Vol. 1, 1892.

Ducor: Bulletin de l'Académie de Médecine, August 4, 1896.

Duguet: Presse Médicale, 1897, No. 39.

Duncker: Zeitschrift für Microscopie und Fleisbau, 1884.

Editorial: Journal of the American Medical Association, January 2, 1898, Vol. xxx, p. 220.

Elschnig: "Actinomykose im Thränenröhrchen," Klinik. Monatsblätter für Augenheilkunde, 1895, Bd. xxxi, p. 189.

Eppinger, H.: "Ueber eine neue pathogene Cladothrix und eine durch sie hervorgerufene," Beiträge zur pathologische Anatomie und zur allgemeinen Pathologie.

Eve, F. S.: "Actinomycosis of the Liver," British Medical Journal, 1889; British Medical Journal, April 10, 1897.

Gasperini, G.: Annales de Micrographie, Paris, 1890.

Gibbs: North American Practitioner, 1889, Vol. i, p. 237.

Grill: "Actinomycose des Magens und Darms," Inaugural Dissertation, Tübingen, 1895.

Hanken: "Case of Actinomycosis in a Gardener," British Medical Journal, Vol. i, 1887.

Harz: "Actinomycosis bovis, eine neuer Schimmel in den Geweben des Rindes," Jahresbericht der Thierärzeneischule zu München, 1877-78.

Hebb: British Medical Journal, 1887, Vol. i.

Hertwig: "Ueber den Actinomyces musculorum der Schweine," Archiv für Wissenschaften und praktische Thierheilkunde, Berlin, 1886, Vol. xii.

Huth: "Ein Fall von Actinomycose des Auges," Hirschberg's Centralblatt, 1884, p. 106.

Israel, James: "Neue Beobachtungen auf dem Gebiete der Mykosen des Menschens," Virchow's Archives, Band lxxiv, 1878, p. 15.

Ibid.: "Erfolgreiche Uebertragung der Aktinomycose des Menschens auf Kaninchen," Centralblatt für die medicinischen Wissenschaften, No. 27, 1883.

Israel, O.: Virchow's Archives, Band xcv.

Johne: "Die Aktinomykose ist eine durch Imfung übertragbare Infektionskrankheit," *Centraltblatt für die medicinische Wissenschaften*, 1880.

Keller: *British Medical Journal*, 1889.

Köhler: "Myxœdem auf seltener Basis," *Berliner klinische Wochenschrift*, 1894.

Lange, F.: "Aktinomykose der rechter Inguinal Gegend," *New York medicinische Monatschrift*, 1894, p. 175-179.

Ibid.: "Cases of Actinomycosis," *ANNALS OF SURGERY*, 1896, Vol. xxiv, p. 371.

Latimer, T. S., and Welch, W. H.: "A Case of Intestinal and Hepatic Actinomycosis in Man, associated with Leukæmia," *Transactions of the American Physicians of Philadelphia*, 1896, Vol. xi, 328-339, 1 pl.; *International Clinics*, Philadelphia, 1896, 6th S., Vol. iii, p. 152-154.

Law: *Medical News*, 1883.

Leblanc: *Journal de Médecine Vétérinaire*, cited by Poncet and Bérard.

Leser: "Ueber eine seltene Form von Aktinomykose beim Menschen," *Archiv für klinische Chirurgie*, 1889.

Lothrop, H. A.: "Two Cases of Actinomycosis Hominis, with Remarks from a Clinical Stand-Point," *Boston Medical and Surgical Journal*, 1895, Vol. cxxxii, p. 300-303.

McFadyean, J.: "The Morphology of the Actinomyces," *British Medical Journal*, June 15, 1889.

McGovern, W. P.: "Actinomycosis," *Medical News*, 1892, Vol. lx, 99-101.

McIntyre, H. B.: "Notes on Actinomycosis," *Boston Medical and Surgical Journal*, 1897, Vol. cxxxvi, p. 84-86.

McKee, E. S.: "Pulmonary Actinomycosis," *Southern Practitioner*, Vol. xii, 1890.

Mallory, F. B.: "A Case of Actinomycosis," *Boston Medical and Surgical Journal*, 1895, 296-300; *Medical and Surgical Reports of the Boston City Hospital*, 1895, 6th S., 179-189, 1 pl.

Marten: *Lancet*, January 12, 1895.

Mayer, A.: *ANNALS OF SURGERY*, 1896.

Minges, J.: "Spontaneous Recovery of a Case of Human Actinomycosis inoculated into a Rat," *Tri-State Medical Journal*, St. Louis, 1895, ii, p. 263-266.

Mixter, S. J.: "Actinomycosis of the Abdominal Wall," *Boston Medical and Surgical Journal*, 1895, Vol. cxxxii, p. 303.

Morris: *Lancet*, June, 1896.

Moser: "Actinomycosis of the Liver," *New York Medical Journal*, August 11, 1894.

Murphy, J. B.: "Actinomycosis in the Human Subject," *New York Medical Journal*, 1895, Vol. xli, p. 17-19.

Murphy, J. B.: "Actinomycosis Hominis," North American Practitioner, Chicago, 1891, Vol. iii, p. 593-607.

Ibid.: "Actinomycosis Hominis, with a Report of Five Cases," Chicago Medical Record, 1891-92, Vol. ii, p. 485-499.

Nocard: "Note sur la Maladie des Bœufs de la Guadeloupe connue sous le Nom de Farcin," Annales de l'Institut Pasteur, 1888.

Ibid.: Annales de l'Institut Pasteur, 1892.

Northrup, W. P.: Medical Record, 1889.

Ibid.: "Actinomycosis in Man," Proceedings of the New York Pathological Society, 1889, 151.

Ochsner, A. J.: "Report of a Case of Actinomycosis," Journal of the American Medical Association, Chicago, 1886, Vol. vii, p. 608-610.

Ibid.: "A Case of Actinomycosis," Medical News, Vol. lviii, 97.

Ohage, J.: "Actinomycosis," Northwest Lancet, St. Paul, 1893, p. 17.

O'Neil: Lancet, 1886, Vol. ii, p. 342.

Park, R.: "Actinomycosis," Buffalo Medical and Surgical Journal, 1892-93, Vol. xxxii, p. 326-337.

Ponfick: "Die Aktinomykose des Menschen," Berlin, 1882.

Ibid.: Verhandlung des Congres der deutschen Gesellschaft für Chirurgie, 1879.

Powers: Philadelphia Medical Journal, Vol. i, p. 966.

Pringle: Lancet, January 12, 1895.

Ibid.: Transactions of the Royal Medical and Chirurgical Society, 1895.

Reidel: "Cancer of the Duodenum with Actinomycosis of the Testicle," Berliner klinische Wochenschrift, June, 1896.

Robin et Laboulbene: "Mémoire sur trois Productions morbides non-descries," Comptus-Rendus de la Société de Biologie, 1853.

Salmon: "Investigations relating to the Treatment of Lumpy Jaw," Washington, 1893.

Satherwaite, F. S.: "Actinomycosis in Man and Animals," Quarterly Bulletin of the Clinical Society of New York Post-Graduate School and Hospital, 1885-86, Vol. v, p. 160-163.

Sauvageau and Radais: "Sur les Genre Oospora," Annales de l'Institut Pasteur.

Schirmer, A.: "A Case of Actinomycosis Hominis," Chicago Medical Journal and Examiner, 1886, Vol. liii, p. 351.

Schroeder, Th. v.: "Actinomyces in unteren Thränenröhrchen," klinische Monatsblätter für Augenheilkunde, 1894, p. 101.

Skeritt, E. M.: "Actinomycosis Hominis," American Journal of the Medical Sciences, 1887, Vol. xciii, p. 75-88.

Syms, P.: "Actinomycosis," ANNALS OF SURGERY, 1897, Vol. xxv, p. 155-171.

Van Niessen: "Die Actinomyces Rein Cultur," Virchow's Archiv, Band cl, p. 482.

Vincent, L.: "Etude sur le Pied de Madura," *Annales de l'Institut Pasteur*, 1894.

Virchow: "Beiträge zur Kenntniss der Trichosis und der Actinomycosi bei Schweinen," *Virchow's Archiv*, 1884, Vol. xcv.

West: "A Case of Actinomycosis of the Pleura and Thorax," *Proceedings of the London Pathological Society*, 1897.

Winchester: "Actinomycosis in North America," *American Veterinary Review*, New York, 1884, Vol. viii, p. 76.

Wolf and James: "Ueber Reincultur des Actinomyces und seine Uebertragbarkeit auf Thiere," *Virchow's Archiv*, Band cxxvi.

Zopf, W.: *Die Spaltpilze*, 3d, Breslau, 1885 (cited).

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. The Treatment of Surgical Tuberculosis with Formalin-Glycerin Injections. By JOHANNES HAHN (Mainz). The author states that, though the employment of iodoform-glycerin injections has been wide-spread, the results have not been satisfactory. He tried iodine-glycerin injections with some degree of success, and two years ago began the injection of formalin. The freshly prepared solution of formalin (a solution of 35 per cent. formaldehyde) was used for this purpose. The results, wherever this solution could be brought into intimate contact with the tubercular focus, were excellent, and in the author's experience this was more effective than other methods. The most suitable field for the injection treatment seems to be the cases of joint tuberculosis which have gone on to suppuration but in which the soft parts are not yet extensively involved. Formalin injection is also adapted to cases of tubercular empyema. The most convenient mixture is made by adding one to five cubic centimetres of formalin to 100 cubic centimetres of glycerin. Those joints, access to the entire surface of which is easy, respond better to the treatment. In the order of their accessibility, these are: the hip-joint, the knee-joint, and, lastly, the tarsal and carpal joints.

That abscesses distant from the tubercular focus should be amenable to treatment by formalin seemed strange to the author, and he was rather astonished to note not only that after one or two injections the pus did not reaccumulate, but in a case of spondylitis the disease was cured quickly with the additional treatment by means of a plaster-of-Paris jacket.

The mode of procedure is as follows: An aspirating syringe of

a capacity of twenty cubic centimetres, and capable of sterilization, is used. The needle of the syringe is introduced into the abscess cavity, and this is emptied. The cavity is thoroughly cleansed, if possible, without causing hæmorrhage, with repeated injections and aspirations of a solution of boracic acid. A quantity of a 1 per cent. solution of formalin-glycerin, equal to one-third to one-half the pus aspirated, is then injected. The parts are kept quiet. A more or less violent reaction follows. The size of the abscess cavity increases considerably. Pain may be severe enough to necessitate the use of morphine. The temperature may rise to above 39° C. This reaction subsides in a few days. If necessary, a second injection may be used at the end of two weeks. Recovery takes place quickly.

Permanent recovery will occur, however, only in those cases in which all the necrotic tuberculous masses have disappeared. Even if these cheesy granulations contain no living tubercle bacilli, they are always a menace to final recovery. These masses are gradually liquefied by the action of the glycerin and can readily be removed by subsequent aspiration. It is not claimed that every case of tubercular joint-disease can be cured by this method. Joints in which the surrounding soft parts had broken down and which were discharging externally were not benefited, as it was impossible to retain the formalin solution in intimate contact with the diseased surfaces for a sufficient length of time. Arthroctomy and resection were often necessitated in this class of cases. Hahn believes that this method of treatment is superior to all similar procedures, particularly to the injection of iodoform-glycerin. He advocates the trial of this comparatively simple method in proper cases before resorting to more extensive procedures. It is to be regretted that lack of time compelled the author to curtail the discussion of this interesting subject and to omit an extensive report of his cases. He reports one case as typical of those treated.

The patient, a boy, three years and three months old, was first seen February 1, 1897. There had been pain in the left leg for the past six weeks. The child was unable to walk without limping and

pain. A large adhesive plaster dressing and a Volkmann splint were applied. These were reapplied several times. At first the pain improved, but soon became more marked. The hip-joint now appeared swollen, and there was intense pain upon the least movement of the limb. On April 23, 1897, an exploratory puncture revealed thin, flocculent pus. All of this fluid, fifty cubic centimetres, was aspirated, the abscess cavity cleansed with a 2 per cent. boracic acid solution, and fifteen cubic centimetres of a 1 per cent. formalin-glycerin solution injected. At the same time a small tubercular granuloma was removed from the skin of the calf of the left leg. A plaster-of-Paris cast was then applied. On June 3, 1897, after every trace of reaction had disappeared and the pain in the joint had subsided to an astonishing degree, an extension apparatus was applied. July 9, plaster-of-Paris "trousers" were applied in addition to the extension. August 23, the child was allowed to walk, still wearing the plaster-of-Paris.

This was removed on November 12. At this time skiagraphs demonstrated that there was very little deformity present in the joint. Soon after this the plaster was left off permanently. The patient could walk without pain and had freedom of motion in all directions. During this period and also afterwards the patient was treated for eczema and phlyctenular conjunctivitis. Up to the present time no symptoms referable to the hip have been observed. There is entire absence of pain, and the child walks without limping. The author promises to report an interesting case of tubercular pyothorax at a future time.—*Centralblatt für Chirurgie*, 1899, Vol. xxiv, pp. 689-692.

RUSSELL S. FOWLER (New York).

HEAD AND NECK.

I. Trephining for Intracerebral Injections of Antitetanic Serum. By ALBERT KOCHER (Berne), assistant in Professor Kocher's Surgical Clinic.

This article is not intended to show the effect of the intracerebral injection, but to demonstrate a simple method by which the serum may be injected. A patient suffering from tetanus was admitted to Professor Kocher's clinic in January, 1899. On the same day five cubic centimetres of the tetanus antitoxin were injected in the following manner :

"The scalp was shaved and cleaned. A point over the anterior portion of the lateral ventricle was determined by means of the craniometer. This point was in front of the precentral furrow at the summit of the sulcus, between the median and upper frontal convolutions, or two and a half to three centimetres laterally from the bregma.

"An injection into the lateral ventricle at this point avoids the motor centres. A 1 per cent. solution of cocaine was injected into the skin. The drill (shown in the original) was applied vertically. It was forced through the skin, and the bone was then bored through. A good instrument will allow the operator to immediately determine the passage through the vitrea. The instrument was withdrawn and the injection apparatus introduced through the aperture and for five or six centimetres into the cerebral substance. The serum was slowly injected, the injection apparatus withdrawn, and the wound closed with a piece of English plaster. On the next day the same procedure was carried out upon the opposite side. During the operation the patient lay perfectly quiet. He did not complain of pain. There was no apparent disturbance in the brain. An intracerebral injection done in this manner is similar to simple puncture in other parts of the body. It may be performed by any practitioner. Roux and Borrel recommend the instrument which they used in their experiments upon animals. They made a skin incision prior to the trephining which needlessly complicated the procedure."

Briefly the history of the case is as follows: Jacob T., twelve years of age, was injured January 7, 1899, by stepping upon a nail. The nail penetrated his shoe and entered the sole of the right foot

for a distance of one centimetre and a half. This punctured wound healed in three days.

The boy walked around and experienced no ill effects until January 22, when swallowing became difficult. Two days later it was impossible to open the mouth without great difficulty. This difficulty increased the next day, and he came to the clinic. *Risus sardonicus* was present, and he had a spastic walk. The features were much distorted, the corrugator was contracted, the eyelids almost closed. The mouth could be opened less than seven centimetres. The chin could not be approximated to the sternum. The abdominal muscles were rigid, also the sacro-lumbalis and latissimus dorsi. The legs and arms were not affected. The reflexes were exaggerated. Temperature, 37.2° C.; pulse, 120. Five cubic centimetres of the antitoxin were injected into the right lateral ventricle. The point of injury on the foot, shown by a small black spot, was cauterized. Other remedial measures were omitted. The patient was quiet during the night. In the morning the temperature was normal. During the forenoon there was increased spasm of the cervical, dorsal, and abdominal muscles. Towards noon this spasm increased and began to affect the muscles of the thigh. Both morning and evening the patient was given an intravenous injection of twenty cubic centimetres of the serum. The evening temperature was 38.4° ; pulse, 110. In the evening four very short attacks of spasm occurred, involving in addition the muscles of the lower extremities. Towards morning the spasms became more frequent, occurring about every ten minutes. The morning temperature was 39.3° . A second intracerebral injection of five cubic centimetres was given, and fifty cubic centimetres were injected intravenously. The attacks, however, continued at five-minute intervals until noon. The patient was given one cubic centimetre of chloral hydrate. In the afternoon the attacks decreased both in intensity and frequency. Chloral hydrate and morphine were given several times. Evening temperature, 39.5° . During the night attacks of spasm occurred every thirty minutes. On the 27th the attacks became less frequent. Temperature, 38.4° ; pulse, 110. No further medica-

tion was resorted to. The muscles remained in the same state of tension, except the thigh muscles, which were no longer affected. On the next day there were no spasms. The reflexes became almost normal. On the succeeding day the temperature became normal, the muscular tension diminished, the mouth could be opened for two and a half centimetres. There were no attacks of spasm. On January 31 there were two slight attacks without rise of temperature. The abdominal muscles were still tense. The other groups were far less tense than before. There were no subsequent spasms. A week later there was present very slight rigidity of the jaw and some rigidity of the abdominal muscles. In three weeks recovery was complete.

The somewhat protracted period of incubation, the slow occurrence of the symptoms, and particularly the slight involvement of the muscles of respiration and deglutition, show that the case was not a severe one. Therefore it is questionable whether recovery was due to the serum. This question is not considered here. It is the object of the paper to describe the technique of the injection. It is interesting, however, to observe that the last three cases of tetanus treated in Kocher's hospital recovered. In all three, intracerebral injections were used, in the last case, according to the technique described above. Spasm of the respiratory muscles was present in this case.—Berne, May 3, 1899. *Centralblatt für Chirurgie*, 1899, Vol. xxii, p. 643.

II. Kocher's Operations for Carcinoma of the Larynx
By DR. F. BUTSCH (Berne). The author reports fifteen cases of carcinoma of the larynx treated by Professor Kocher since 1890. Twelve of these were operable. The first seven of the series were operated upon by Kocher's former method,—i.e., general anæsthesia, tampon-cannula, total or unilateral extirpation of the larynx by means of the so-called T-incision, and subsequent feeding with pharyngeal tubes. This technique was essentially altered in the later cases of the series. In place of general anæsthesia, local anæsthesia by the infiltration

method of a 1 to 100 solution of cocaine was employed. The patient was placed in the Trendelenburg position and the use of the canula dispensed with. A median incision was made from the hyoid bone over the larynx, exposing the thyroid cartilage. The thyro-cricoid ligament was perforated and the thyroid cartilage split vertically with scissors.

The halves of the cartilage were retracted, thus completely exposing the interior of the larynx and the tumor. The parts to be removed are anæsthetized by pencilling them with a 1 per cent. solution of equal parts of cocaine and antipyrin, and the tumor excised widely with the knife, or better with the thermocautery. If possible, only the soft parts are thus excised, but in cases in which the cartilage is involved Kocher uses the scissors to remove the affected cartilage subperichondrially. The bleeding surface is cauterized and powdered with iodoform, and an ordinary tracheal canula introduced. The wound is tamponed and left open. Special position of the body, as well as feeding by the tube, is not necessary.

Of the twelve cases operated upon, one died as a result of the operation; two are considered cured, one four years and a half, the other two years and a half after the operation; three are free from recurrence, but have not been observed for a sufficient length of time to consider them definitely cured.

These good results would not have been possible had not the diagnosis been made early in the majority of the cases.

The paper concludes by advocating simple mesial section of the thyroid cartilage, and circumscribed excision of the new growth in the Trendelenburg or in Rose's position without general anæsthesia.

[Pieniazek (*Centralblatt für Chirurgie*, 1894, p. 131) removed a number of endotheliomata and also several carcinomata from the larynx without general anæsthesia, employing essentially the same procedure as followed by Kocher. Rose's position is perhaps better adapted to these cases than Trendelenburg's.]—*Deutsche Zeitschrift für Chirurgie*, Band 1, p. 481.

III. **Surgery of Malignant Disease of the Larynx.** By DR. GLUCK (Berlin). Despite the brevity of this paper it gives a clear picture of the present status of the surgery of the larynx. It is a defence of the rational treatment of malignant disease of the larynx by means of total or partial laryngectomy. Neither the endolaryngeal method of treatment nor the simple external method by means of thercotomy (Semon) are sufficient in the majority of cases. The author recommends the radical surgical procedure which he eulogizes as "logical, useful, and legitimate."

Gluck has had a large experience in these cases. He has operated upon forty-five cases of his own, a short *résumé* of thirty-seven of which is added to his paper. Of the last twenty-six cases upon which he has operated, twenty-three recovered. This shows the great steps which have been made in this branch of surgery. Operative technique is well considered. The author shows how, starting with preliminary resection and dislocation forward of the trachea (recommended originally by Gluck on the basis of his experiments on animals), the danger of foreign-body pneumonia was gradually eliminated, then the danger of wound infection, until now the operation gives both good functional and phonic results. This paper is the result of many years of experience, and will well repay closer study. —*Thérapie der Gegenwart*, 1899, Hefte 4 und 5.

IV. **Resection of the Œsophagus for Carcinoma.** By F. DE QUERVAIN. The author gives the history of a patient in whom, following gastrostomy, he resected a considerable portion of the œsophagus. The disease was so extensive that it was impossible to suture the lower segment of the œsophagus, so this was left to its fate. It soon contracted and became impassable. There was a rapid recurrence in the trachea.

The literature on this subject is not extensive, but what cases there are, the author has collected with the view of determining the indications for operation, its limits, and the method which should be

followed. It is of primary importance that these cases should receive the benefit of earlier surgical interference. They should not be left until actual stenosis has occurred. The upper and lower limits of the disease must be accurately mapped out, as upon these depends the advisability of operating. The use of the Röntgen rays and the probe will be useful in determining this. Prognosis has not been very good up to the present time. Preliminary tracheotomy is not to be employed, unless part of the trachea is to be removed. When tracheotomy is used it is left to the last stage of the operation. Œsophagotomy below the obstruction is to be avoided as a preliminary procedure. The formation of a gastric fistula is indicated both to strengthen poorly nourished cases prior to the main operation and to allow their nutrition after operation. Following the removal of the diseased portion, the divided ends of the Œsophagus must be united, if possible. If this is not possible, the lower end is sutured to the external wound, and if even this is impossible, as in de Quervain's case, in which the Œsophagus was removed to the level of the arch of the aorta, the lower end must be simply left to its fate. Care must be also taken that the upper segment is not obliterated. A mucous fistula is much less inconvenient, as well as less dangerous, than the necessity for the patient having to cough up the accumulated secretions, and thus run the risk of a foreign-body pneumonia. The after-treatment of the wound is of extreme importance. The mediastinal half of the wound must be dressed independently of the pharyngeal wound.—*Archiv für klinische Chirurgie*, Band lviii, Heft 4.

RUSSELL S. FOWLER (New York).

ABDOMEN.

I. Valve Obstruction in the Bile-Ducts. By DR. CARL LAUENSTEIN (Hamburg). Socin and Courvoisier, as well as Fenger, have described certain consequences resulting from the presence of

gall-stones acting as ball-valves in the bile-ducts. Langenbuch describes this in his recent work upon "Surgery of the Liver and Bile-Ducts." This action of a calculus as a ball-valve has been observed in the cystic and also in the common bile-duct. The author, in the course of over eighty operations upon the biliary apparatus, has also found this condition. The condition presented by these cases could only be explained on the hypothesis of a valve-obstruction. In several cases the gall-bladder was found neither distended with bile nor calculi. It could be picked up between the fingers like an empty bag. Calculi, and these usually small ones, were found in the cystic duct. The presence of a completely empty gall-bladder, in case of calculi in the cystic duct, can be explained in but one way, by the mechanism of a valve. Presumably the calculi did not prevent the flow of bile from the gall-bladder, but rather prevented bile entering the bladder from the liver.

Some of those cases in which the gall-bladder is filled with innumerable small calculi, but no bile, and which, as soon as the calculi are removed, commence discharging bile abundantly, are undoubtedly the result of this valve-obstruction in the cystic duct. Then again, those cases of hydrops, of empyema, of a gall-bladder distended with pure bile, and some cases of enormously enlarged gall-bladder, with calculi in the cystic duct, can best be explained by attributing a ball-valve action to such calculi. Here the action of the valve is opposite to that in the case of the empty gall-bladder. Bile is able to flow into but unable to leave the bladder. It is impossible to explain in any other way those cases of enormously distended gall-bladders filled with what is microscopically pure bile. The automatic arrangement of the cystic duct with its haustra and valves highly favors with the presence of a calculus the formation of a ball-valve. The "key-stone calculus" of Riedel, found so often in the neck of the bladder, favors this hypothesis.

It is conceded that inflammatory processes within the gall-bladder may take part in the distention. Of late years the author has had the contents of the gall-bladder in his cases submitted to bacteriologic

examination. The colon bacillus, either alone or associated with the staphylococcus, has been repeatedly found. This was true, whether the fluid was of normal appearance or whether it was flaky or turbid, or even as clear as water.

The remote consequences of this ball-valve obstruction are not easy to determine. In any event, whether the obstruction results in distention of the viscus or its complete emptying, the physiologic function of the gall-bladder as a reservoir is seriously interfered with. This action of the gall-bladder must be of some importance. Normally, bile collects in the gall-bladder between the processes of digestion, and flows thence intermittently, while with the viscus out of commission the flow of bile is continuous. Consequently the sphincter, said by anatomists to exist at the site of the opening of the common duct into the duodenum, must be in a constant state of relaxation. Instead then, of an intermittent flow of large quantities of bile into the duodenum, there is a slow, continuous stream. Thus there is constant danger of infection from the duodenum entering the relaxed papillæ and traversing the ducts. This is favored, too, by the slow flow of the bile instead of the quick physiologic gush.

The author states the possibility of infection as the general cause of lithiasis on account of the frequent presence of bacteria in the cases he has operated upon.—*Centralblatt für Chirurgie*, 1899, Vol. xxix, pp. 793-796.

II. The Treatment of Tumors of the Mesentery.

By DR. P. BEGONIN. The treatment of tumors of the mesentery is thoroughly discussed in this paper, based upon those cases operated upon by Demons, and a number of operations carefully collected from the literature of the subject. In addition, the author has experimented on animals concerning the viability of the intestine after portions of its mesentery have been excised. As solid tumors of the mesentery are of far less frequent occurrence than cysts, there are a greater number of operations for the latter reported.

Operation is indicated in both varieties as their prognosis, if untreated, is bad. This is due to their growth, and to the peritonitis, cachexia, or intestinal obstruction which they may cause. Exploratory puncture was employed without dangerous consequences in fifty-four cases of solid and cystic tumors. Of sixteen cystic tumors, seven were cured by puncture; the others, particularly the chylous, dermoid, and multilocular cysts recurred. The author reserves this treatment for blood cysts and unilocular serous cysts, which can be brought into contact with the abdominal wall. He advises the greatest precaution in puncturing, and condemns this treatment for all other varieties,—*echinococcus* cysts, dermoid tumors, chylous and other cystic tumors. Nor does he think that subsequent injection of tincture of iodine or solutions of sublimate are permissible. In cases in which simple puncture is not indicated, and in cases where it has been tried and failed, incision if possible at one operation, or extirpation is to be employed. Incision cured from 88 to 93 per cent. in a series of forty-nine cases. In some of these cases the cure was not effected for some time. Extirpation was successful in from 60 to 68 per cent. in a series of twenty-five cases. This, however, is not indicated in cysts having extensive adhesions.

As regards solid tumors of the mesentery, twenty-nine of a series of thirty-six were treated by extirpation. Fifteen of these cases died and fourteen recovered, making a mortality of 52 per cent. Of these fatal cases, eight died of shock, four of peritonitis; the other three died of "*fetid diarrhœa*," caused by gangrene of the intestinal mucous membrane. In some of the cases dying of shock, small necrotic areas in the intestine could be demonstrated. This, the author explains, from his experiments in animals, is due to the cutting of the larger arteries of the mesentery during the removal of the tumor. A reason may be found for some of these cases dying of shock from the size of the tumors, which weighed from thirteen to forty pounds. Of fifteen cases of lipoma, eight recovered and seven died; of four cases of sarcoma, two recovered .

and two died; of seven cases of fibroma, three recovered and four died; one case of carcinoma died, and one case of tubercular tumor. There were no recurrences, but had some of the fatal cases lived, they would undoubtedly have recurred. Of eleven cases in which the exploratory incision was employed, four died. Malignant growth with extensive adhesions are best left undisturbed.

The technique of the operation is described and the difficulties met with are discussed. Attention is called to the danger of injuring large vessels, the solar plexus, the ureter, and the bowel. Six cases are reported in which resection of the intestine or entero-anastomosis was done. Incisions parallel to the mesenteric vessels are advised in order to spare them as much as possible, and thus avoid malnutrition of the intestinal wall. The vascular loops at the insertion of the mesentery into the bowel are to be particularly avoided. (The original paper is warmly recommended to those desiring to study the literature of this subject exhaustively.)—*Revue de Chirurgie*, 1898, Vols. iii and vii; 1899, Vols. ii and iii.

III. Gastro-Enterostomy by Podrez Method. By DR. N. A. SOKOLOFF (Moscow). In the autumn of 1898, Podrez published a method of performing gastro-enterostomy (*von Langenbecks Archiv*, 1898, Vol. lxii, Fasc. 2), which consisted in the application of two ligatures crossing each other through the walls of the organs taking part in the anastomosis. After being placed these ligatures were tied tightly, thus causing a constriction-necrosis of the parts held in their loops. Nine experiments in animals convinced him that the anastomosis thus provided for always took place. An autopsy upon a patient, upon whom this method had been used, likewise showed that the anastomosis had taken place.

According to Podrez the operation is very simple and can be performed by any surgeon in a few minutes. Operative shock is thus avoided. Anastomosis takes place in from two to four days. After Sokoloff had used the method in three cases a paper was published by Warneck and Kisselew (*SURGERY*, 1899, February, Russian),

stating that in their experiments upon dogs they had found that the method had failed to produce the desired anastomosis in six cases. The parts had been examined at intervals of from four and one-half to twenty-four days after the operation. Podrez answered this communication in the *Wratsch* (1899, No. 1), expressing his astonishment at this unexpected result. He had operated on four cases since his first publication, and twice was able to verify by subsequent necropsy the existence of an anastomosis. He tried to explain Warneck's and Kisselew's failures on the ground of neglect of certain of the conditions. The portion of wall included in the ligature must exceed one or two centimetres, otherwise the resulting fistula will be too small for food to pass through. Furthermore, the ligature must include the entire thickness of the wall. It is especially important that the constriction be extreme. In conclusion, Podrez said he expected quite a different objection, on the ground of secondary stenosis of the fistula. He advocated, as a modification of his method, the application of four ligatures through the walls of the viscera so as to constrict a portion of the wall from four to six square centimetres in size. Sokoloff's fourth case was operated upon by this modification. Since then an article by Schalita appeared (*Wratsch*, 1899, No. 7), advocating the inclusion of as much as three centimetres of the walls in the ligature. He proposed a wider range of usefulness for the operation, which originally was restricted to stricture of the pylorus, the result of malignant disease. Two cures were reported. Sokoloff remarks that it must be conceded that the negative results of Warneck and Kisselew are very important, as they demonstrate that Podrez's method will not always succeed in establishing an anastomosis. The author's cases are as follows: •

The first case, a patient of fifty-one years of age, suffered from a large pyloric tumor, completely obstructing the passage of food. Podrez's original method was employed. Sokoloff was not satisfied with the crossed ligature above, but surrounded the site of the future anastomosis with a series of sutures. In addition, the loop of small intestine was sutured to the stomach wall, after the method of Kap-

peler (*Deutsche Zeitschrift für Chirurgie*, Vol. xlix). The case pursued an uneventful course until the eighth day. The symptoms assured the formation of the anastomosis. On the eighth day pneumonia developed, to which the patient succumbed after five days. The necropsy showed an aperture one centimetre wide at the site of the anastomosis. One ligature was still adherent, the other had disappeared. Microscopic examination of the growth proved to be carcinoma.

The second case was a patient, thirty-one years old, with symptoms of carcinoma of the pylorus. Podrez's operation was done as above, but afforded no relief. Vomiting continued and the patient died in four and one-half days. There were no wound complications. Everything was clean and dry. There was no communication at the site of the anastomosis. The ligatures had cut into the tissues. It was with difficulty that they could be found lying between the folds of the stomach. The tumor was a large lympho-sarcoma. (This case will be described more fully in the *Berliner klinische Wochenschrift*.) On the same day, the same operation was performed upon a man of forty-seven years, a case of pyloric stenosis. There was a tumor in this case, but it was only discovered during the operation, as it lay beneath the left lobe of the liver. The case pursued a regular course without rise of temperature. The symptoms indicated the formation of the anastomosis. The patient improved steadily, but relapsed soon into the former exhausted condition, and finally died on the forty-third day of the operation. The necropsy showed the tumor, an adeno-carcinoma, stenosing the pylorus to such an extent as to hardly allow the passage of the little finger. The loop of intestine entering into the formation of the anastomosis was solidly attached to the stomach. The two crossed ligatures were found *in situ*. Cicatrices in the mucous membranes were found over the ligatures, which were rather loose. There was no communication present.

The fourth and last case was a patient of forty-three years, who had cicatricial stenosis of the pylorus following the ingestion of sulphuric acid. In the course of two months the pylorus was so much

contracted that no food could pass. An anastomosis after Podrez's modification of his former procedure was done, a quadrangular portion of the walls of the opposed viscera being eliminated by means of four ligatures. The stomach in this case had so shrunk, by reason of cicatricial contraction, that it was with difficulty that sufficient stomach wall could be secured for the purposes of the anastomosis. The entire stomach was no larger than a man's fist. The site of anastomosis was surrounded by a line of sutures, but it was impossible to suspend the intestine by Kappeler's method. The patient bore the operation well. The wound healed quickly, and the anastomosis gradually formed. The patient took plenty of food in small quantities, and increased rapidly in weight. When last seen, fifty-five days after the operation, the patient was perfectly well.

This makes four cases which the author has operated upon by Podrez's method, three by his original method, and one by the later modification. Of the three cases, in two no communication followed, though all the conditions necessary for its formation were observed. In each case the ligatures included more than two centimetres of the walls; they passed through the entire thickness; they were constricted with the author's entire strength, and, finally, the operations were for stenosis of the pylorus, yet an anastomosis did not occur.

It must be concluded from the above that the operation does not always produce the desired result. The experiments by Warneck and Kisselew support this statement. The method is unreliable and should not be employed. Future experiments may show why a communication does not result in all cases. Sokoloff points out that the procedure is founded on the supposition that all the visceral layers necrose simultaneously. Reichel ("Die Lehre von der Brucheinklemmung," 1886) showed in his experiments, that in cases of incarceration, the serosa and muscularis, on account of their abundant anastomotic blood-supply, resisted pressure much better than the poorly nourished mucosa. Bowel epithelium, like renal epithelium, quickly perishes, if its blood-supply is interfered with. Garré (*Beiträge zur klinische Chirurgie*, Vol. ix) also calls attention

to the fact that the mucosa necroses first in cases of incarceration. There are different views on this subject, but the author believes that he will be supported in his theory that necrosis from ligation does not occur simultaneously in all the coats of the intestine, and this is probably also true in the case of the stomach. If the necrosis from the constricting ligature affects the mucosa first before gangrene of the muscularis and serosa has taken place, loosening of the ligatures must result, and its further necrosing effect be annulled. If this does occur, the muscularis and serosa, on account of their rich blood-supply, would soon recover from the temporary constriction to which they had been subjected. This theory accounts for the finding of the ligatures lying loose *in situ* and the cicatrization in the mucosa over them. Future experiments in animals must demonstrate whether this is the true theory or not. But one fact is certain,—Podrez's method does not produce the required result in all cases.

Theoretically, Podrez's modification of his earlier procedure should offer more chance of success than the original method itself, but in this also the chance of simultaneous necrosis of all the walls must be taken; and, in addition, it possesses greater technical difficulties. The older methods of anastomosis must be employed until Podrez's procedure can be made successful in every case.

When the author reported his results with this operation before the Surgical Society of Moscow, March 23, 1899, Dr. Fedoroff reported the results of his experiments on dogs. The formation of the anastomosis was successful in some cases, but more often no communication was found. In some cases the ligature cut through the intestinal wall, but not through the stomach.—*Centralblatt für Chirurgie*, 1899, Vol. xx, pp. 590-594.

IV. Intestinal Anastomosis by Invagination. By PROFESSOR DOMINICO MORISANI (Genoa). The author is convinced that the good results of a bowel-suture are not dependent upon the complexity, nor the strength, nor the number of layers, but rather upon

the certainty of protecting the thread from infection from the contents of the intestinal canal. He proposed a method in 1888 (D. Morisani, Sull' affrattamento rettilineo con giusta posizione dei margini, Napoli, *Progresso Medico*) which he had used successfully on several occasions. This procedure offering absolutely no obstacle to the faecal current, insured an uninterrupted course of wound healing. It was, however, necessary to follow the technique exactly in order to obtain a good result.

The author later undertook a series of experiments with the idea of rendering his former procedure easier of performance and more certain in results. He wished to devise a method in which the technique would be easier and the suture line would be protected against infection from intestinal contents.

The procedure is briefly as follows: Following the required resection, the mucous membrane of the end of the intestine to receive the invaginating portion is grasped with forceps, incised vertically for from four to six centimetres, and a circular flap of mucous membrane of this breadth removed. The other end of the intestine is now invaginated for a distance of several centimetres into the lumen thus prepared. The two ends are held thus in apposition by two or three fixation sutures, and a continuous suture of silk is applied around the gut in such a manner as to securely fix the entire denuded surface of the invaginating, to the corresponding serous surface of the invaginated end. This suture begins at the mesenteric border of the invaginating bowel. The needle pierces the bowel wall, and, entering the muscular coat of the invaginated bowel, it traverses this muscular coat to the level of the free edge of the denuded portion of the invaginating bowel. The needle is brought outside at this point, and this, the first stitch of the continuous suture, is tied, the end being left long. This over-and-over stitch is continued around the entire circumference of the bowel. [These stitches are placed somewhat obliquely, two centimetres apart, while the method of application is the same in either case.] When the mesenteric border is again reached, the last stitch is secured by tying it to the end of the first,

which was left long for the purpose. This produces a slight convexity. The remainder of the operation is completed in the usual manner.

This procedure, as is evident from the above description, belongs to the numerous class of intestinal anastomoses by invagination and resection of mucous membrane. It closely approximates Harris's method, but is simpler in technique and more reliable. In Morisani's procedure the continuity of the intestinal mucous membrane is maintained by the invaginated portion of bowel. This enables the intestinal contents to pass from the proximal into the distal part without interfering with the healing process.

Morisani claims that by the *excision* of a flap of mucous membrane of the distal end, the operation is made simpler, quicker, and more complete than when this mucous membrane is shaved off as in analogous procedures. Suturing the raw surface to the serous one accelerates mutual agglutination, and allows of greater solidity. Examination of the portions of bowel operated upon in this way twenty-four hours, eleven days, and three months after the operation demonstrates that the method meets all the requirements.

If the site of an anastomosis be subjected to a strong stream of water twenty-four hours after operating, the suture line will be found impervious and will resist the pressure of the water for a long time. On longitudinal section the small segment of the invaginated ends appears funnel-shaped, contracted at its free edge, dilated above, the point of greatest dilatation lying over the site of the suture.

The mucous membrane lines the free edge of the funnel. The union of the invaginating and invaginated bowel appears solid at the line of suturing. The loops of the thread and the needle holes, though still discernible, are level with the surface of the intestine. The circumference of the invaginated end is increased by a spindle-shaped swelling.

On the tenth day after the operation the site of anastomosis is still spindle-shaped, and its surface uneven, but neither the line of union nor the suture are discernible. On longitudinal section the ends of

the intestine appear almost unaltered. The two ends are inseparably united by connective tissue. The convolutions of mucous membrane almost reach the point of union. The silk suture remains unaltered in the hyperplastic tissue.

After three months have passed, the spindle-shaped swelling is much reduced, but has not entirely disappeared. The serous covering is still somewhat uneven. The continuity of the intestinal canal is complete. On longitudinal section, the invaginated portion is still somewhat shortened. Its mucous membrane joins that of the invaginating bowel.

The microscope shows that these cases unite *per primam*. The invaginated portion of bowel shortens because of the cicatricial contraction of the serous coat, and the retraction of the longitudinal layer of muscular fibres so as to reach the angle of junction of the two bowel ends. The reaction of the circular muscular fibres throws the mucous membrane into folds. The longitudinal muscular fibres of the two ends are finally united, in about three months, by the interposition of fibrous tissue in which lie very thick-walled vessels.

Connell (*Philadelphia Medical Journal*, 1899, No. 1, p. 57) gives the following references on the subject of anastomosis by invagination: Ramdohr (Heister, *Institutiones Chir. Amstelodami*, 1739) first invaginated the proximal end of the intestine into the distal end, maintaining the invagination with one stitch at the convex border. Louis (*Médicale Académie de Chirurgie*, Paris, 1757) removed the mesentery from the proximal end, thus rendering disinvagination less probable. Chopart and Desault ("Nouveau Dictionnaire de Médecine et de Chirurgie," Vol. xix) ingeniously invaginated incomplete transverse wounds. Jobert ("Mémoires sur les Plaies du Canal intestinal," Paris, 1827) invaginated the proximal end after inverting the margin of the distal end, thus obtaining sero-serous union. Beclard ("Nouveau Dictionnaire de Médecine et de Chirurgie," Vol. xix) united the edges, invaginated, and then constricted with a circular ligature, which ultimately cut through into the lumen, causing a sero-serous union. Assaki and Duplay (Bishop, E. S.,

Medico-Chirurgical Transactions, London, Vol. lxx, p. 343) modified the method of Beclard by ligating in two sections. Chaput ("Congrès Français de Chirurgie," 1889) scraped the mucosa from the distal end and then invaginated. Only one row of sutures was applied. The experimental results were very poor. Harris (*Chicago Medical Recorder*, 1892, Vol. iii, p. 523) invaginated after removing the mucosa from the distal end. He inserted two rows of stitches, securing each end in place, taking care not to penetrate the mucosa, thus holding the parts in accurate apposition, and securing sero-fibrous union. Nicol (*Glasgow Medical Journal*, 1896, Vol. xlvi, p. 37) devised a method very similar to that of Harris. Skelly (*ANNALS OF SURGERY*, September, 1898) removed the mucosa from the distal end, the serosa from the proximal end, then invaginated, holding the ends in place by means of two rows of sutures.

The chief objections to Morisani's as well as all these methods are the danger of post-operative progression of the invagination, sloughing of the ends, stricture at the site of union, and the difficulty in differentiating the distal from the proximal end. Paul and Harris claim it is immaterial which end is invaginated, while Robinson says it is of vital importance. It would seem that this was of extreme importance in Morisani's procedure, for the free edge would be apt to act as a valve, and interfere with the fæcal current. In any event, if invaginated for any distance, it would be apt to contract subsequently and form a stricture at this point.

Most of these methods have not met with general approval, and the reason for this is given by Senn in the *Journal of the American Medical Association*, August 12, 1893. He says, in part, in speaking of the Harris method: "Although all of the animals operated on by this method lived, and the specimens obtained showed excellent results, I cannot but believe that any method which deviates from the principle established by Lembert is a step in the backward direction."—*Centralblatt für Chirurgie*, 1899, Vol. xxxii, pp. 881-885.

GENITO-URINARY ORGANS.

I. Profuse Renal Hæmorrhage, with Macroscopically Unaltered Kidneys. By DR. B. FLÖDERUS. The author observed in Lennander's clinic a case of renal hæmaturia in which the kidney showed no macroscopic changes. On microscopic examination the kidney was found to be the seat of a disseminated sclerosing glomerulitis with advancing sclerosis in the neighboring connective tissue, and to a slight extent fatty degeneration and atrophy of the epithelium.

Led by this, the author began a study of the published cases of so called essential hæmaturia. These cases he divided into five groups.

- (1) Renal hæmaturia, occurring in cases of hæmophilia.
- (2) Renal hæmaturia due to vasomotor disturbances.
- (3) Renal hæmaturia from mechanical causes.
- (4) Renal hæmaturia occurring in varieties of nephritis.
- (5) Incompletely described cases of essential renal hæmaturia.

It is to be regretted that most of the cases which have been reported up to the present time are so insufficiently described. As a result of his researches the author states that the integrity of the kidney from which the hæmorrhage came was not proven histologically in a single case.

As for treatment, these cases are to be kept in bed, and tonics and dietetic measures used. Hydrotherapy and suggestion may be beneficial. If internal treatment fails, operation is advised, except in hæmophilia. Operation must not be delayed too long, particularly if malignant disease or tuberculosis is suspected.

In conclusion, a review is given of the results obtained with various operations, lumbar incision, acupuncture, nephropexy, pelveotomy, nephrotomy, exploratory resection, and nephrectomy.—*Uppsala Läkarefören. Förhandl. N. F., Band iv, p. 233.*

II. Congestive Phenomena in the Pathology of Renal Hæmorrhage. By DR. M. POUSSON (Bordeaux). The author draws attention to the fact that in cases of apparently spontaneous hæmaturia the kidneys are quite frequently the site of a chronic interstitial nephritis. The microscopic examination of two kidneys which had been removed because of profuse renal hæmorrhages, showed inflammatory foci in the cortex without other changes. The history of one such case is given. The patient, a female, twenty-eight years of age, had slight pain during the act of urination when eighteen years old. With this exception she had always been in good health until three months before consulting the author. During these three months there had been profuse hæmaturia, violent pain, and at times the retention of large coagula in the bladder. Cystoscopy revealed a pale bladder mucosa, but no essential changes. The mouth of the left ureter was normal, and from it clear urine was trickling. The mouth of the right ureter was swollen and œdematous, and from it reddish-colored urine escaped. The right kidney was cut down upon and explored. It was found to be voluminous and congested. On incising the cortex this was found dark, reddish, ecchymotic in places; elsewhere it was pale and anæmic. Nephrectomy was performed, and the final result was everything that could be desired.

In the discussion of this case Poirier mentioned a case in which death occurred with asthmatic symptoms three months after he had performed nephrectomy. He strongly advises against nephrectomy in cases of hæmaturia in which, in the course of the preliminary nephrotomy, macroscopic evidence of chronic nephritis is found. It is all too likely that the other kidney is also affected with similar changes. Piqué reported a similar case, and joined with Poirier in warning against nephrectomy in such cases. Instead, he advocated simple nephrotomy. Nimier reported a case in which hæmaturia continued after removal of the left kidney. The patient had received a blow upon the left side five years before. Inflammatory changes were found in the kidney at the time of its removal. Reynier con-

tended that, in the cases in question, beginning renal tuberculosis was present, and for this reason early nephrectomy was indicated. In three such cases in which he had operated tubercular changes had been present. (In the cases reported by the other authorities there was no evidence of tuberculosis, although the kidneys were examined with this in mind.) *Bulletin et Mémoires de la Société de Chirurgie de Paris*, t. xxiv, p. 590.

III. Unilateral Hæmaturia of Obscure Origin. By DR. T. ROVSING. The author, having studied Klemperer's article on hæmorrhage from healthy kidneys, which the author claimed to have diagnosed and cured without operation, and in which operation was said to be absolutely contraindicated, was led to investigate the subject for himself. He subjected all the cases of hæmaturia "of nervous origin" available in literature, and in addition four cases coming under his personal observation, to a strict analysis.

From this study he concludes: That all cases of hæmaturia "of nervous origin" will not stand thorough examination, as in some instances pathologic conditions existed, floating kidney, tumors in the pelvis, inflammations of the bladder, which could explain the hæmorrhage; in other cases the report was insufficient to exclude the possibility of the presence of some pathologic change. The author's personal observations show that displacement of the kidney with torsion of its pedicle may play a part in the production of the hæmorrhage. In one case the pressure from a tightly laced corset was the direct cause of a very large renal hemorrhage. But even after the most discriminating study some cases still remain which were unexplainable. As severe cases cannot be explained with certainty on a "nervous" basis, it is best to make an exploratory lumbar incision in cases of obscure unilateral renal hæmorrhage, the more so as experience teaches that such a course exercises a benignant influence upon the hæmaturia even when no cause is found.—*Centralblatt für die Krankheiten der Harn und Sexualorgane*, 1889, Vol. xi, Fasc. 11 and 12.

IV. Etiology of Floating Kidney. By DR. BÜDINGER.

In this paper the author endeavors to solve some of the problems concerning floating kidney. The idea that the location and mobility of the kidney cannot be determined by researches upon the cadaver on the hypothesis that in the dead the intra-abdominal pressure which produces these changes is absent is erroneous. Authorities differ greatly as to the normal location and amount of the mobility of the kidney. From a careful study of sixty cadavera Büdinger found that the kidneys were fixed in eleven cases, and in the remaining cases were more or less mobile. He considers the plane of connective tissue which extends from the kidney around the posterior aspect of the renal vessels, fusing in part with the connective tissue surrounding the aorta, and in part with the fascia covering the lumbar portion of the diaphragm, to be the proper suspensory renal ligament and its principal means of support. Relaxation of this ligament and of the connective tissue surrounding the kidney results in floating kidney. This relaxation is the result generally of injury. The neighboring organs act as auxiliaries in increasing the mobility. In speaking of the treatment the author calls attention to the necessity of obliterating the sac-like space in which the floating kidney lies.—*Mittheilungen aus den Grenzgebieten der Medicin und Chirurgie*, Band iv, Heft 3.

V. A New Method of Cystorrhaphy. By T. JONNESCO (Buda-Pesth).

The author has devised a method of suturing the bladder which has met with uniform success in the eight cases of suprapubic cystotomy in which it has been employed, as well as in the experiments upon animals which preceded its use in man. The method used is one of the so-called "imbrication" methods, and consists of the following steps: First, the mucosa and muscularis are separated from each other for a distance of half a centimetre to two centimetres from either edge of the incision. This flap of mucous membrane is resected, and the mucous edges sutured with catgut.

Second, the muscular flap is placed over the line of suturing in the mucous membrane and fixed there by three lines of sutures,—a U-shaped suture which unites the base of the flap with the edges of the bladder wound; a suture which fixes the free edge of the flap; and a third suture which unites the mucous-membrane portion of the flap with the bladder wall. By this means the incisions in the mucosa and muscularis are kept from directly overlying each other, and urinary infiltration thus obviated.—*Gazette des Hôpitaux*, 1899, No. 2.

VI. Hernia of the Bladder,—Inguinal Cystocele. By DR. W. BECKER. The author states that the bladder forms part of an inguinal hernia rather more frequently than is generally supposed. Among thirty cases of inguinal hernia operated upon at Bruns's clinic, during a period of eighteen months, in no less than eight cases the bladder was found to be present in the hernial sac. These herniæ were all congenital and of considerable size. From this circumstance the author concludes that the bladder is more likely to be present in large herniæ than in small ones, as it is in the former that the most predisposing condition exists,—*i.e.*, the traction of the large hernial sac on the parietal peritoneum. This is opposed to Lotheissen's views on the subject. Four of the eight cases reported were primary (Brunner), lying extraperitoneally and adherent to the hernial sac. Four cases were secondary. The first case was particularly interesting, as here not only the bladder but also the ureter was found present in the sac. In the fifth and eighth cases diverticula of the bladder had first entered the hernial sac. In all these cases lipomatous masses were noted between the bladder and the peritoneum. At points where the peritoneum was freely movable more considerable collections of adipose tissue were found. These are important from a diagnostic stand-point, as in many cases the amount of prolapsed bladder wall is small, and it is the presence of the adipose tissue at the inner side of the sac that first awakens the suspicion that this viscus is present. Furthermore, from the relation of this mass

to the epigastric artery we may determine which variety of cystocele is present. Treatment consists in the reduction of the prolapsed viscus with a portion of the wall of the sac and an operation for the radical cure.—*Beiträge zur klinische Chirurgie*, 1899, Vol. xxiii, Fasc. 1.

VII. Hernia of the Bladder. By DR. F. ROCHE. The author reports a case of a patient of forty years on whom he operated for a scrotal hernia. It was only when, in the course of the operation, the bladder was opened for a distance of three centimetres that it was discovered that this viscus was present in the hernial sac. The rent in the bladder was sutured, and the patient made an excellent recovery.

A short review of the history of hernia of the bladder is given by the author. The inguinal variety occurs almost without exception in males between fifty and seventy years of age. It is due to atrophy or paralysis of the bladder, such as follows hypertrophy of the prostate and stricture of the urethra. Lipoma of the bladder and other auxiliary causes must also be taken into account. The majority of the cases are of the inguinal variety. Most frequent in occurrence, apart from this, is inguino-scrotal, crural, perineal, obturator, vaginal, and urethral, in the order named.

The cystocele is almost invariably unilateral, up to the present time only four cases being reported in which both sides were affected. The contents of the sac may be bladder alone, but more frequently some other viscus is involved in addition, particularly intestine. The author briefly discusses the relations of the bladder to the peritoneum forming the sac.

Diagnosis is difficult. The numerous diagnostic points mentioned in the text-books are apt to prove deceiving. The lesion in most cases is discovered during the course of the operation for the cure of the hernia. Prognosis is favorable if hernia of the bladder is suspected previous to operating or if it is discovered during the course

of the operation before injury to the bladder wall has been done. If the bladder is identified only after its cavity has been invaded, the result depends entirely upon the accuracy of the suturing of the wound edges and their healing *per primam*. Should small fistulæ persist, the prognosis is still favorable, as these either close spontaneously or readily yield to minor procedures.—*Annales des Maladies des Organes Génito-Urinaires*, 1899, i.

RUSSELL S. FOWLER (New York).

EXTREMITIES.

I. Operative Technique in the Formation of Amputation Stumps. By PROFESSOR AUGUST BIER (Greifswald). The method which was described by Professor Bier in 1897, No. 31 of the *Centralblatt*, offered the disadvantage that in reality two amputations were necessary in order that the action of the saw might not be impeded in making the bone-flap. This double amputation, probably, prevents many surgeons from using the procedure, though it gives a better stump than could be obtained by other means. Von Eiselsberg ("Storp-Weber osteoplastischen Unterschenkelamputationen und deren Technik," *Deutsche Zeitschrift für Chirurgie*, Band xlviii, Heft 4); and Bunge ("Zur Technik und Kasuistik der osteoplastischen Unterschenkelamputation nach Bier," *Deutsche medizinische Wochenschrift*, 1899, No. 22 und 23) essentially improved the procedure by avoiding the preliminary amputation. Bier has also endeavored for a long time to make the bone-flap without doing the preliminary amputation. He tried using a chisel, but found this impracticable, as the hard cortex of the bone was easily splintered. It was, indeed, possible to make a movable flap in this manner, but this consisted mostly of single splinters of bone. Stumps so found do not lack sensation as completely as do those in which a solid bone-flap is made. The usual saws with adjustable blades are neither steady nor strong enough to form the flap of the hard cortex. The same is true

of the Gigli wire saw. Therefore the author has modified Helfrich's arch saw, which he advocated for this purpose in his earlier communications on this subject.

The two locks of the saw have each three slots for holding the blade, so that the angle of the blade with the arch may be changed at will. After the periosteal flap is marked out, the blade is placed upon the bone in an oblique direction. When the blade has reached the necessary depth, it is placed parallel with the long axis of the bone, and the sawing continued until the flap has reached the proper size. A periosteal elevator is now introduced into this saw incision to pry the surfaces apart and allow the direction of the saw to be changed at right angles to this incision, so that the remaining portion of the bone may be sawn through. In place of sawing all the way through this remaining portion, Bier saws almost through and breaks the rest. The jagged edges are trimmed with rongeur forceps. The flap is pediculated, as previously described, and the posterior amputation of the soft parts completed. The blade is then set in the plane of the arched handle, and first the tibia and then the fibula sawed through at the points where they approach the edge of the skin-flap. The remainder of the operation has been described in a previous contribution.

Two conditions are necessary in order to form the bone-flap in the manner described above. The blade must be extremely narrow and must be set with considerable tension. The blade should not measure more than three millimetres in width, and must be kept well sharpened. It can be used with advantage in other osteoplastic resections, as in the case of the femur and humerus.

Stöpler, of Greifswald, supplies these saws.—*Centralblatt für Chirurgie*, 1899, Vol. xxxv, pp. 953-956.

II. Treatment of Varicose Ulcers by Stretching the Peroneal Nerve. By DR. N. BARDESCU (Bucharest). The author claims priority over Chipault, who, on April 15 of the present year,

at a meeting of the Biologic Society of Paris, advocated the treatment of varicose ulcer of the leg by means of nerve-stretching. In proof of his claim the author refers to the *Bulletin de la Société des Sciences médicales de Bucharest*, December, 1897. Chipault's paper confirms the previous claims made by the author. Two cases are reported in which the internal saphenous vein was first resected under cocaine, and in one case nine and in the other case ten days later the common peroneal nerve was stretched under chloroform narcosis. Both the resection and the nerve-stretching could be done at one sitting.

The common peroneal nerve was selected in these cases on account of the extensive character of the ulcers. Naturally the nerve which corresponds in distribution to the site affected should be selected. Both cases made an excellent recovery. Temporary anæsthesia following stretching was noticed.—*Centralblatt für Chirurgie*, 1899, Vol. xxviii, pp. 769-771.

III. Treatment of Varicose Ulcers by Total Extirpation of the Internal Saphenous Vein. By DR. E. CASATI (Ferrara). Extirpation of the entire internal saphenous vein from the femoral junction, in case of leg ulcers and varices, has been followed by excellent and permanent results in the author's hands. In order to avoid the long skin incisions, from seventy to eighty centimetres in length, Casati proceeds as follows: Eight centimetres below the femoral fold he makes a four-centimetre incision exposing the vessel. The vein is isolated as high up as possible and the proximal end ligated.

The vein is then isolated as far downward as possible and traction put upon it. This causes it to become prominent for the whole extent of the thigh. Another four-centimetre incision is made four centimetres above the knee, and the vessel is isolated subcutaneously upward and downward in the same manner. It is then drawn out of the wound. The same procedure is repeated through two incisions below the knee, so that finally the entire vein has been re-

moved. It is not necessary to ligate the lateral branches. One of the advantages of the operation is the placing of the first incision below the fold of the groin ; at the latter point a dressing is difficult to hold in place. Secondly, the avoidance of a cicatrix at the knee which is apt to prove painful. The author reports three successful cases by this method.—*Reprint*.

RUSSELL S. FOWLER (New York).

REVIEWS OF BOOKS.

ELECTRO-HÆMOSTASIS IN OPERATIVE SURGERY. BY ALEXANDER J. C. SKENE, M.D., LL.D. New York: D. Appleton & Company, 1899.

When Ambroise Paré gave to surgery the hæmostatic ligature, he conferred upon mankind a boon, the value of which it is difficult for us of this later day to appreciate. The progress of surgery has improved the technique of his operation, but these improvements have been supplied from progress in other lines of science: his was the introduction of a mechanical principle. The escape of blood from a blood-vessel, excepting in association with the physiological functions of the female generative organs, is a pathological condition, and healing takes place in the presence of an abnormal state of the tissues. The opening through which the blood escapes must be stopped or surrounded by a new and foreign sort of tissue. This is represented by coagulated fibrin, devitalized or disorganized vessel-wall, or ligature material,—one or all. Before the days of Paré the devitalization and charring of the bleeding area was the thing; but he addressed himself to the bleeding point alone. In the work which lies before us we are invited to revert to the pre-Paréan principle of mass treatment. This the author applies to the broad ligament, to the pedicle of ovarian cysts, to the vermiform appendix, and would even extend it to operations upon the breast and other regions.

It is grievously unfair to analyze the disadvantages of the hæmostatic ligature in the light of the surgery of twenty-five years ago. The author in his introductory remarks makes out a case against the ligature; but it is not the ligature of modern times against which he inveighs. The surgeon to-day has at hand such

materials as are absolutely sterile. He amputates the thigh, ties the femoral artery with catgut, and the thought of the possibility of the inefficiency of the ligature never comes to his mind. Many years ago all of the direful accidents cited by the author may have followed the use of the ligature; but in these times the surgeon, with a clean and steady hand, finds it a beneficent agent. Concerning the application of the sterilized catgut ligature in the presence of infection the author says, "A ligature thus contaminated is not absorbed, but acts as a foreign body for the promotion of evil and the interruption of the process of repair, and is responsible for the bad results which have sometimes followed when I had operated according to all the rules of modern surgery." This is in a measure true, but what does the author propose to do about it? He substitutes for the ligature a much larger mass of disorganized tissue to macerate in the septic products, and, like the ligature, to offer a nidus for the propagation of micro-organisms. Where a bleeding vessel has been stopped, whether by nature or by art, there is the material for culture media.

In the cul-de-sac of Douglas the author checks the bleeding from adhesions after oöphorectomy by means of the electrotherm. He says, "The technique is exceedingly simple, and the results most satisfactory, compared with the old way of ligating the larger vessels (always a most difficult thing to do) and using persulphate of iron or hot water to stop the oozing. In fact, I never was able to arrest bleeding and oozing completely and quickly, and make the parts clean and dry in pelvic surgery of this kind, until I devised this method of operating." It is surely a great blessing to have the perchloride of iron eliminated from abdominal surgery. But how mediæval it all sounds.

Chapter VII of this book is devoted to electro-hæmostasis in appendectomy. Here the author reports a case of appendicitis, and describes his operation for the same. "The first grasp of the forceps was upon the meso-appendix, close to its mesenteric attachment. A current which heated the forceps to 180° F. was then induced for

half a minute. Upon removal of the forceps the tissue was found to be not charred but dried, having the appearance of white, horny matter. Scissors were used to bisect this desiccated area. A second seizure was made upon the appendix itself, close to the caput coli, and the same current continued for ninety seconds. The forceps was then removed and the tissue divided in the line of the desiccated area away from the caput." No sutures or ligatures were applied. The abdomen was then closed; and the man who did it had a brave heart, and a soul full of faith.

The principle of hæmostasis described in this book consists in desiccation of the tissues by an instrument heated by means of an electric current. The mechanical devices are worked out with much ingenuity. Thus, in the hæmostatic clamps, only the grasping surface of the blades is heated. It is done quickly and under perfect control, and is applied to the small forceps, for grasping single vessels, as well as to larger instruments, which are made to grasp the whole pedicle of an ovarian tumor. The author also effects hæmostasis by cautery points or buttons, which he heats by means of electricity.

He describes in full the methods of amputation of the cervix and of removal of the uterus by means of the electro-cautery, as devised and practised by John Byrne. The book closes with chapters on asepsis and antiseptis in surgery, describing the methods for preparing suture materials and dressings, sterilization of instruments, the general conducting of operations, and hospital sanitation.

Something good may come out of this book. It advocates a peculiar principle and practice, which may possibly find some special application in the surgery of the future. Unfortunately, the book is unscientific and unfair. The misrepresentations of the modern and accepted methods of surgery can only have the effect to discredit the claims of superiority of the author's methods. To advocate the supplanting of simple, satisfactory, and surgically thorough operations by methods which are essentially crude and unsurgical and withal complicated, seems strange to come from such a source.

The book simply shows what can be done by one who is willing to make a hobby of electrothermics as applied to surgical clamps.

LEWIS S. PILCHER.

CHIRURGIE DE L'ESTOMAC. Par F. TERRIER, Chirurgien de l'Hôpital Bichat etcie, et H. HARTMANN, Chirurgien des Hôpitaux. Paris: G. Steinheil, Editeur, 1899.

Recent advances in the diagnosis of gastric disorders, taken with the success attending operations on the stomach reported from many quarters, make this subject one of peculiar interest. The book opens with a brief *résumé* of diagnostic measures,—palpation, inspection, distention, use of various sounds, gastro-diaphany, direct inspection, and radiography. Under the latter a number of ingenious methods are described. Commenting on the use of the stomach-tube, the following is emphasized: "Loss of weight, plus delayed digestion, form an indication for operation," the contention being that these almost always point to pyloric stenosis. When these symptoms are present lavage is discouraged, as offering only temporary amelioration, while the disease at the pylorus is given time to spread. A point of much importance, and one often neglected, the authors think, is examination of the *fasting* stomach.

Gastrotomy is dealt with in an interesting chapter which describes the relations of the stomach, the operation and after-treatment, and details some of the curiosities found in cases of foreign body in the stomach. Figures are given, showing a mortality as low as 17 per cent. in carefully conducted cases.

Gastrostomy naturally follows, being reported in the order of its development from the early simple attempts of Verneuil and of Howse to the more elaborate procedures of Frank and Kocher. Some of the authors' personal experiences, presented in detail, form interesting and valuable additions to the literature on this branch of abdominal surgery. Briefly described, Dr. Hartmann splits the left rectus and sews into the slit of the posterior sheath a diverticulum of stomach which, after being passed between the muscle and the deep portion of

its sheath, again penetrates the belly of the muscle, and is sutured to the skin a short distance to the left of the median line, a simplification of the Sabaneef-Frank-Kocher method. Two cases reported at length show excellent results, the patients surviving seven months and two and a half months respectively, and during those periods being free from the annoyance of leakage of gastric juice.

Gastro-enterostomy is fully treated of, the chapter including not only a careful *résumé* of the various forms of operation, varieties of suture, mechanical adjuvants, and so on, but also a large number of clinical reports of patients on whom the procedure had been practised. Briefly summarized, gastro-enterostomy is favored in pyloric stenosis, gastric ulcer, gastric stasis, gastro-succorrhœa, and repeated small hæmorrhages, and discountenanced for profuse hæmorrhage, simple gastrectasis, enteroptosis, hyperacidity, and the like.

Under "gastrectomy" are included all the operations involving not only partial or complete ablations of the stomach, but of the pylorus as well. Kocher's method, which the authors advise and follow in its essential feature, is pictured in full, the sketches being particularly lucid. As in previous chapters, a number of clinical reports are included, and form by no means the least interesting portion.

Loreta's operation, pyloroplasty, cardioplasty, gastropexy, and gastrorrhaphy, each receive a brief description. Under the last head the clinical history is given of one of Dr. Hartmann's cases. The stomach, which in its dilated condition presented the fundus three inches below the umbilicus, was successfully gathered as to its anterior surface by four "puckering strings," including the serous and muscular coats, and suspended to the anterior abdominal wall. Complete cure of an obstinate long-standing dyspepsia, and rapid gain in weight resulted.

Chapters on the surgical treatment of bilocular stomach, perforating ulcer, and perigastric adhesions complete the book, which is a decided addition to surgical literature, the excellent illustrations and fine press-work adding greatly to its attractiveness.

HENRY GOODWIN WEBSTER.

LA THÉRAPEUTIQUE DES EMPYÈMES. Par Le Docteur E. CESTAN, ancien Interne des Hôpitaux de Paris. Paris: Georges Steinheil, 1898.

As a reason for presenting this volume to the profession, the author mentions the rapid strides in modern medicine, especially in the department of bacteriology, pointing out that the classical work of Bouveret is silent on this subject, while the conclusions of Debove and Courtois-Suffit must be modified in the light of more recent discoveries.

Dr. Cestan, accordingly, proceeds to develop from such a preface a book of nearly four hundred pages, treating of empyema somewhat minutely. Dividing his subject into two main portions, treating respectively of recent and chronic empyemas, he again subdivides them into sections relating to etiology, bacteriology, operations, sequelæ, accidents, results, and indications. This topical arrangement makes reference extremely simple.

In glancing through the book one is struck with the care which the author has expended in gathering together cases bearing on all possible aspects of empyema. The remark is especially called forth by a section devoted to accidents and complications, referable to treatment of acute cases. Without stopping to particularize such occurrences as injury to the intercostal artery, to the lung, diaphragm, heart, etc., to distant complications the result of infection or embolism, attention may be briefly called to a class of phenomena but little understood and not altogether explicable on either toxic, neurotic, or mechanical grounds. This class includes, among other manifestations, syncope, convulsions, hemiplegia, and paræsthesia, either alone or combined. A large number of such cases are here presented and classified for analysis, though the conclusions reached fail to throw much new light on their etiology.

The chapters on treatment review the several sorts of operative interference, and by a comparison of figures, early resection of a rib and drainage without irrigation is advised as the procedure giving the

best results. In selected cases siphon-drainage is recommended as hastening cure.

Chronic empyema occupies the latter third of the volume, the greater portion of the section dealing with its operative treatment. Dr. Cestan describes at some length the various measures for obliterating the cavity left by the retracted lung, such as Estlander's, Schede's, Quenu's, and the like, devoting considerable space to a comparison of them. A series of tracings from operative cases and experiments on the cadaver are of interest.

The book throughout shows a thorough acquaintance with the literature on the subject, as well as a mastery of practical thoracic surgery. It should prove useful and valuable alike as text-book and reference work.

HENRY GOODWIN WEBSTER.

PROGRESSIVE MEDICINE. Edited by HOBART AMORY HARE, M.D.
Vols. i, ii, and iii. Lea Brothers & Co., 1899.

The editor of the work before us thinks that what the busy physician needs is a well-told tale of medical progress in all its lines of thought, told by some one especially qualified to call out such matter as is worthy of attention, and of importance and necessity to the practical practitioner. To accomplish this Dr. Hare has enlisted a corps of most capable and advanced men, each of whom tells in his own language the story of medical progress in his special line. It is the intention to publish four such volumes each year, covering the entire round of practical medicine, a volume appearing every three months. The three volumes which have thus far appeared eminently justify the editor's faith in his ingenious plan. The first volume opens with a chapter on the surgery of the head, neck, and chest, by Dr. J. Chalmers Da Costa, which is an admirable critical study, carrying with it the personality of Dr. Da Costa. Under the subject of actinomycosis of the face and neck, the author observes that in every case of supposed malignant disease we should consider the possibility of actinomycosis; and he calls attention to the statements

of Billroth, made several years ago, that in a series of cases of supposed inoperable sarcoma brought to his clinic, 10 per cent. were cases of actinomycosis. The procedures for the treatment of this disease are clearly defined.

The author utters a wise word when he cautions the surgeon, in treating tuberculous glands of the neck, to determine the area from which the diseased glands receive lymph, and examine this area for foci of disease or for places of entrance of tubercle bacilli.

Tuberculosis of the parotid gland, tracheotomy under local anæsthesia, carcinoma of the lip, wounds of the thoracic duct, harelip and cleft palate, and carcinoma of the tongue are some of the subjects treated. The author refers to the recent articles of Murray, Heath, Mumford, and Edmund Owen on the subject of harelip. Butlin's recent statistics on carcinoma of the tongue are given. He advises complete amputation for all cases.

A chapter upon the surgical operations about the chest tersely reviews the subjects of wounds of the lung, foreign bodies in the bronchus, bronchiectasis, tumors of the lung, gangrene of the lung, tuberculosis, empyema, pneumothorax, suture of the heart, aneurisms of the aorta and innominate artery, and carcinoma of the breast,—all of these subjects are discussed from the stand-point of real modern surgery.

Under the subject of brain surgery, the discussion upon idiocy is opened with the statement that "The surgical treatment of idiocy is futile, hopeful anticipations of a few years ago having failed of realization." The treatment of tumors of the brain is admirably presented, as is the surgical treatment of epilepsy and abscess of the brain, bullets in the brain, osteoplastic craniectomy, operations for trigeminal neuralgia, and the treatment of traumatic intracranial aneurism. Besides the surgical chapter in Vol. i, this book also contains chapters devoted to the diseases of children, pathology, infectious diseases, laryngology and rhinology, and otology,—each written by a specialist in that particular line.

Vol. ii contains four chapters: surgery of the abdomen, in-

cluding hernia, by Dr. W. B. Coley; gynæcology, by Dr. J. G. Clark; diseases of the blood, didactic and metabolic disorders, diseases of the spleen, thyroid gland, and lymphatic systems, by Dr. A. Stengel; and ophthalmology, by Dr. E. Jackson.

Coley reviews, from the modern stand-point, the subjects of the use of drainage in the abdominal cavity, the use of rubber gloves in surgery, abdominal incisions, and the treatment of intestinal paralysis and peritonitis by enterostomy. The surgery of the stomach is given special consideration. The recent views concerning perforating ulcer of the duodenum are clearly presented. The chapter also contains sections on the surgery of the liver and gall-bladder, with a careful review and presentation of the subject of intestinal anastomosis.

The chapter on hernia is an honest analysis of the various operations. The views of many surgeons, American and European, who have written recently upon the subject of appendicitis, are given, with especial reference to the treatment of this disease. Laparotomy for intestinal perforations in typhoid fever is discussed in connection with the recent operative successes in this branch of surgery. The latest experiences with gunshot wounds of the abdomen are analyzed.

The influence of castration upon the female constitution is still a question full of unsettled points, which Clark has done much to clear up. He also discusses the advisability of removal of the healthy ovary in cases of hysteromyomectomy, with special reference to Abel's recent contributions to the literature of this subject. The results of Knauer's experiments in the transplantation of the ovaries, showing that the engrafted portion continues its active function, are summarized.

The histogenesis of dermoid cysts and teratomata of the ovary, methods of closing the abdominal wound, and their relationship to post-operative hernia, gonorrhœa in women, tuberculosis of the peritoneum, foreign bodies accidentally left in the abdominal cavity, ultimate results in vaginal and abdominal hysterectomy, conservative operations upon the ovaries and tubes,—these are some of the subjects the recent contributions to the literature of which have entitled

them to consideration in this book. There is a chapter on retroflexion of the uterus, which embodies all there is of the subject. We commend it particularly to the school of gynæcologists which dilly-dallies with the retroverted womb. This chapter presents the rare spectacle of the introduction of a stanza of verse into a thoroughly scientific didactic discourse without detracting from the real seriousness of the theme. The "*Uterus Quidam Retroflexus*" of Professor Säger, of Leipzig, will be perpetuated as a gynæcological classic.

In Vol. iii, the first chapter is devoted to diseases of the thorax and its viscera. Of the surgical diseases considered are empyema, traumatic rupture of the diaphragm, foreign bodies in the bronchi and lungs, neoplasms of the lungs, pulmonary abscess, ether pneumonia, diseases of the mediastina, œsophagus, and thoracic duct. A case of lavage of the heart and pericardium for purulent pericarditis is reported.

Other chapters are upon diseases of the skin, diseases of the nervous system, and obstetrics. A very complete review brings the subject of brain tumor up to date. Extrauterine pregnancy and the recent literature of Cæsarean section, pregnancy and fibroids, cancer complicating pregnancy, and appendicitis complicating pregnancy are discussed.

This volume embodies the progress in medical literature for the past three months. Articles which are not reviewed are referred to, and their place of publication given. The same style and good scientific judgment in selecting material prevails in this volume as in the preceding ones.

JAMES P. WARBASE.

TRANSACTIONS OF THE SOUTHERN SURGICAL AND GYNÆCOLOGICAL ASSOCIATION, Vol. xi. Published by the Association, 1899.

This volume contains the twenty-one surgical papers and the eleven surgico-gynæcological papers, with their discussions, which were presented before the association at its last session, held at

Memphis, Tenn. For eleven years this society has published in most creditable form a well-edited volume of transactions.

A short paper, by Dr. W. E. Parker, summarizes his experience with gunshot wounds in the Spanish-American war. His observations seem to be in line with those of other observers, who are rapidly producing a new chapter in military surgery. Among his conclusions is this, that "abdominal work should not be attempted in the field unless there are symptoms of hæmorrhage." Previous to this late war the surgery of gunshot wounds of the abdomen was a pretty well settled question, but now again our views of the matter are confused. This is particularly shown in the discussion upon the paper before us.

Dr. H. A. Kelly has a beautifully illustrated paper on the repair of the lacerated perineum. The paper on thoracic resection for tumors growing from the bony wall of the chest, by Dr. F. W. Parham, is a valuable contribution to the literature of this subject. It involves a review of the heretofore reported cases, together with two additional cases operated upon by the author.

JAMES P. WARBASSE.

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